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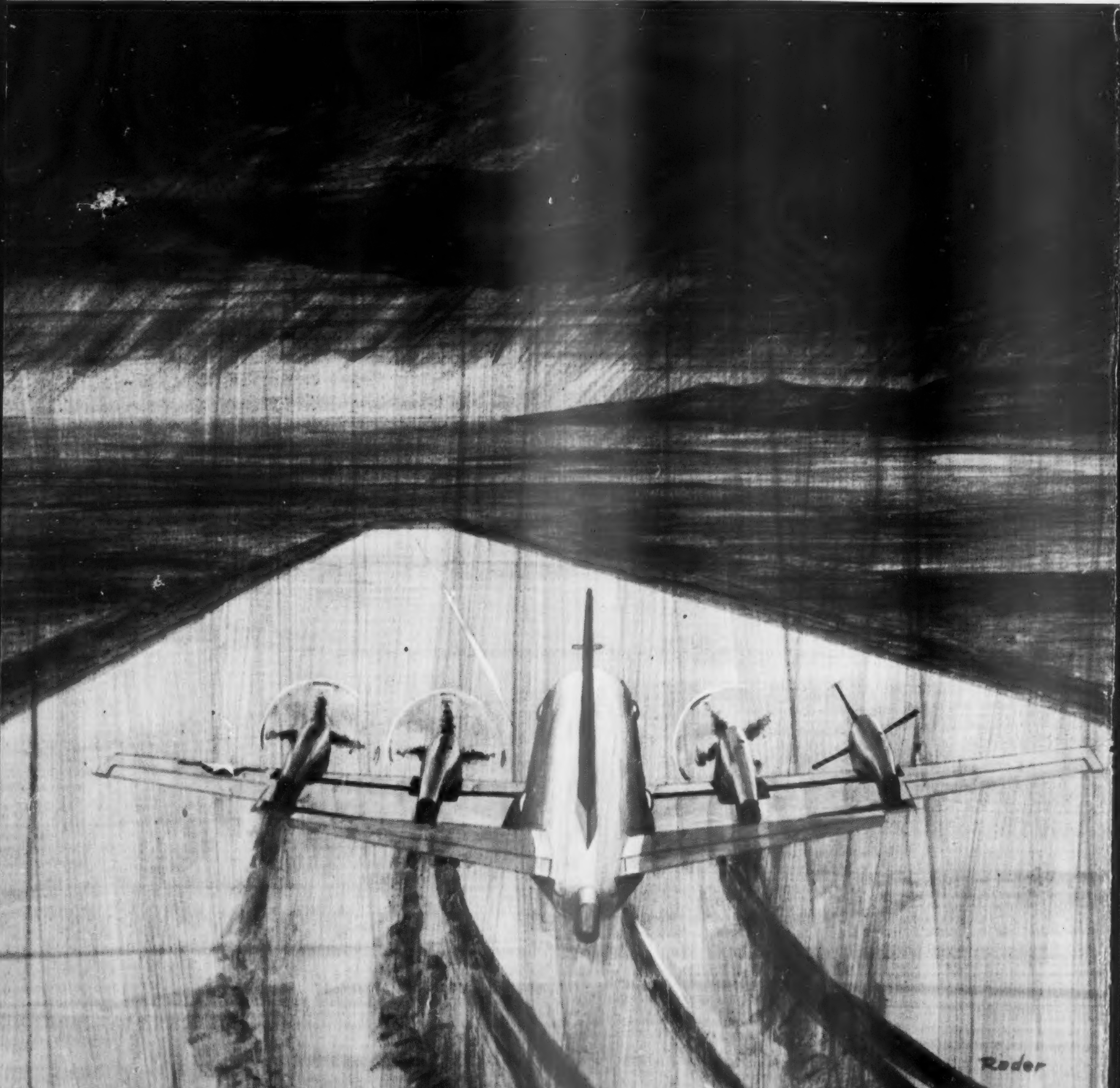
approach

JULY 1975 THE NAVAL AVIATION SAFETY REVIEW

An Uneventful Three-Engine Landing or

What the Incident



By LCDR C. J. Winters
VP-24

Reports *Really* Mean

ALTHOUGH in naval aviation we report, examine, and investigate all aircraft accidents, there are many occurrences of near accidents that have not been fully reported. Whenever aviators gather, these exciting moments are recounted, often with embellishments. Usually these near mishaps are reported in brief, terse Safety URs and Incident Reports, but never with the background color and enthusiasm that accompanies a firsthand report on the seventh telling. These stories, besides being entertaining, often reveal small relevant details and give an indication of the effectiveness of emergency procedures. The following three incidents occurred in P-3 aircraft and are worth retelling, the way they *really happened!*

• *An incident report read: "On takeoff roll, a power loss was observed on No. 1 engine, followed by an autofeather. Flight was aborted and aircraft returned to line." A more complete narrative can now be related.*

The P-3C crew had been enjoying a 3-day layover in a European capital while on a NATO exercise, but on the last night of their stay, the visit turned sour. The flight engineer was relieved of his wallet containing all of his money and the rest of the crew was low on resources. On the morning of their scheduled departure, the weather was rainy and overcast. At the briefing, the crew learned they were tasked for a surface surveillance mission, in an area heavy with air traffic. As they began their preflight at 0600, the flight engineer was still grumbling about his lost wallet. The PPC was preoccupied with air traffic considerations and the forecast weather at destination.

The ceiling was 400 feet with 3 miles visibility when the P-3C began to roll down the wet runway. As the PPC, occupying the copilot seat, called 80 knots for a power check, the pilot felt a sharp swerve to the right and yelled, "Power loss!" The flight engineer shortly thereafter also called out, "Power loss!" which was followed quickly by the pilot's command to feather No. 4.

The PPC from the copilot position saw the aircraft swerving to the right and echoed the command, "Feather No. 4." The flight engineer replied, "Don't you mean No. 1?" Sensing the continuing swerve to the right, the PPC shouted again, "Feather four," at which time the flight engineer quickly secured the engine. The power was reversed on the remaining engines and the takeoff aborted. On rollout it was discovered that the No. 1 engine was also shut down, and in fact, the autofeathering of No. 1 prop was the reason for the swerve. Subsequent investigation revealed a malfunction of the autofeather system on No. 1 engine.

Two important facts are brought out by this incident:

When a prop feathers due to a malfunction in the autofeather system, the propeller increases in pitch, momentarily producing an increase in thrust.

Minimum control speed-ground is highly dependent on the horsepower of the operating engines.

• *Another incident report describes events as* 1
follows: "All four SHP indicators began fluctuating approximately 800 SHP. Prop SYNC SERVOS were secured with no change. As temp datum controls were being nulled, No. 2 generator off light illuminated and the SHP indicators steadied. Under/over voltage reset procedures were performed in accordance with NATOPS. Generator OFF light remained on steady. Performed precautionary engine shutdown. An uneventful three-engine landing followed."

A more detailed narrative makes exciting reading. The P-3C crew was relieved to find the entire coast of Greenland clear. They flew over their destination, Sondrestrom, and started a gentle descent into the deep fiord heading toward the sea, enthralled by the majestic scenery. Upon reaching the ocean, they reversed course and headed back to their destination, a few miles ahead, deep in the fiord. The visibility was unlimited as the P-3C leveled at 800 feet for maximum viewing of the sheer, snow-covered mountains and ice floes.

Glistening peaks towered on either side of the aircraft as the pilot turned the controls over to the copilot while he took photographs through the side window. Suddenly the autopilot disconnected. Inertial two failed. Flashing radar altitude warning lights illuminated. The copilot's altitude and heading indicator began spinning, and a 800 h.p. loss was observed on all engines. The aircraft was

immediately nosed over to maintain flying speed as the pilot grabbed the controls.

The P-3C was descending into the fiord as the flight engineer pushed the power levers full forward in an attempt to regain power. Condition V was set for ditching as a crewmember looked into the flight station to ask what was going on. The flashing warning lights and the panic-stricken looks on the flightcrew answered his question as he turned and ran for his ditching station. The SYNC SERVOS were turned off with no effect.

Just as the flight engineer was setting the temperature datum controls to null, two more lights illuminated. The electrical power caution light and the generator two off light came on and a surge of horsepower was felt. Attempts to reset generator No. 2 were to no avail. Assuming a generator mechanical failure, the crew reluctantly feathered No. 2 engine to prevent disintegration of the generator. To the relief of all, normal power response was obtained and the aircraft was leveled at 500 feet.

An emergency was declared and a three-engine landing made at Sondrestrom. Subsequent investigation revealed a mechanical failure of No. 2 generator. It is theorized that the first failure of the generator was an improper phase relationship in the output power. This improper phase was not detected by the protective system which is designed to trip the generator off the line in such a situation. With No. 2 generator feeding out-of-phase power to main a.c. bus A, the temperature datum system went to full take, reducing the fuel flow to the engines. The autopilot and inertial two likewise failed because of the improper bus A power. The crew reacted in a correct and timely manner. If they had waited much longer to feather the No. 2 engine, the

generator may have disintegrated as its charred casing and worn bearings indicated.

• *The incident report read: "Climbing through 2000 feet, crew observed fluctuating TIT and RPM on No. 4 engine. Crew secured No. 4 and completed uneventful three-engine landing."*

It was 2115 when a P-3A taxied up to the runway at Sangley Point, Philippines. On board was a full crew, four Mk-54 depth bombs, a dozen parachute flares on the wings, and 61,000 pounds of fuel. The aircraft was scheduled for a 12-hour Yankee Team patrol in the Tonkin Gulf. The ceiling was 1000 feet with scattered thunderstorms in the area and drizzle.

As the aircraft took the runway, the flight engineer said that he would like to do a full power runup of No. 4 engine because "it doesn't seem to act right." After a full power runup, the flightcrew was satisfied with all engines and takeoff roll was commenced. Lifting into the humid night air, the aircraft climbed slowly at maximum takeoff weight of 127,500 pounds. The pilot went on instruments immediately after takeoff. Scattered lightning flashes could be seen in the distance as the aircraft climbed into a broken layer of stratus clouds. The pilot was fully occupied with flying instruments and listening to the Philippine air controllers. The copilot was handling communications, giving the command to set Condition IV, and completing the climb checklist. At 1500 feet, a thud was heard on the starboard side of the aircraft and a swerve was felt. Fluctuating horsepower and TIT gages for No. 3 engine were noted by the flightcrew.

The engine was quickly secured and the aircraft returned to the airfield for downwind entry. Considering the deteriorating weather and the flight engineer's suspicions about No. 4 engine, the plane commander elected to land immediately. Neither pilot had ever landed a P-3A over 91,320 pounds (the maximum recommended landing weight for the P-3A), but since landings up to maximum takeoff weight are permitted in emergencies, it was decided that this was indeed an emergency. The plane touched down at 140 knots and used slightly more than 6000 feet of wet runway to stop.

The aggressive crew was still in good spirits, and with the duty officer's concurrence, decided to launch again, this time with the ready-alert aircraft. An hour and 30 minutes after their original takeoff time, the crew was again lined up on the runway. The aircraft weight was only 122,000 pounds since the alert fuel load would suffice for the fixed return time of the mission.

Conditions remained the same on takeoff and as the P-3A climbed through 2000 feet, several thuds were heard in the direction of the starboard wing. The flight engineer observed decaying RPM and rapidly rising TIT on No. 3 engine. The plane commander saw severe RPM, horsepower, and TIT fluctuations on No. 4 engine and said, "Feather." The flight engineer promptly pulled the E-handle on No. 3 engine. This action was followed quickly by the plane commander shouting, "No, I meant No. 4." Number 4 engine E-handle was promptly pulled by the flight engineer. A shallow turn back to the airfield was started and the secure checklist was completed on both engines. The TACCO entered the flight station to report in an excited voice that No. 4 engine had been torching, with flames extending nearly to the tail prior to its being secured.

The aircraft now weighed 120,000 pounds as it broke out of the overcast at 800 feet. After a quick conference in the flight station, it was decided that the hazards of landing so heavy with two engines out warranted an attempt to start No. 3 engine. The restart checklist was completed and a smooth airstart resulted. The landing checklist was quickly reviewed and a three-engine landing made. Total flight time logged by the crew was .5 hours for the first flight and .3 hours for the second. This must be some kind of a record for rate of actual secured engines in P-3 aircraft.

Investigation of the engines revealed corrosion in the electrical connectors of the propeller electronic SYNC SERVO system. Incorrect electronic signals were increasing the propeller pitch to the point of causing compressor stalls which were the thuds heard by the crew. Looking back on the events of the evening, it was discovered that the engine problems occurred when the engineer was syncing the props as part of the climb checklist. It is possible that if the climb checklist had been delayed slightly, the pilots would not have been so engrossed with other items and may have noticed that the SYNC SERVOS were the source of the problem.

It is apparent after reading complete accounts of incidents such as these that in many cases, official reports do not always tell the complete story. For this reason, it is important that those who fly and have emergencies relate their experiences for the benefit of others who "haven't been there before." Informal squadron discussions and articles such as this both serve that important function. Perhaps, also, aviation safety officers should depart somewhat from the technical, sterile, and abbreviated format of the typical Incident/UR Report to include more details, so that a clearer description of what really took place is presented.

As a final thought, there is one common aspect to the three, unrelated incidents reported in this article. Although some oversights may have been made, the crews reacted to malfunctions using NATOPS procedures and all are still here to relate their experiences.

THE 'G' IN POOPY SUIT IS SILENT

By LCDR Red Best
FITWING ONE Safety

THERE has long been a saying in aviation that "You can always tell a fighter pilot, but you can't tell him much." My Granny Tittle, who had her own Hall of Fame for Fighter Pilots, used to add ". . . and wears a big watch."

Commanders may tell a crewman to wear the watch, but if it doesn't fit or if it gets in his way during an airborne hassle – well, he just doesn't wear the watch next time he expects a lofty challenge.

You can also tell a crewman to wear a particular combination of flight gear which has been designed for his protection and performance maximization. But, if he feels that it is cumbersome, grossly uncomfortable, or interferes with his performance during air combat maneuvering, he doesn't wear that particular part of flight clothing the next time he flies.

In the Good Book according to Saint Somebody (OPNAV 3710.7G, Verse 705), the three commandments for wearing the antiexposure suit are explicitly set forth. NAVAIR 13-1-6.7, *Aviation Crew Systems Manual,* authorizes the CWU-33/P VWS (ventilated wet suit) as the saving grace for meeting these requirements. You might also know this attire as the poopy suit.

Notice how the "G" is silent?

Verse 706 of the same Good Book sets forth another commandment wherein the basic criterion for the wearing of the antiblackout suit ("G" suit to you) is finitely defined.

Herein lies the problem.

The TACAIR community is presently ignoring one or the other (sometimes both) of the above requirements during the winter flying months. Depending on the anticipated mission, aircraft crews are wearing either the VWS for antiexposure protection without the G-suit, or they are reverting to the summer flying coverall and waffle-weave, long-john combination so the G-suit can be worn to provide for a higher G tolerance.

"Why?" you ask so observantly.

Well, it seems that the CWU-33/P VWS and G-suit do not meet the basic mobility/comfort standards demanded by TACAIR crews. The antiblackout or G-suit is deleted from the ensemble because it is extremely restrictive to body movement if an attempt is made to wear it inside the VWS. And to try to wear it on the outside while stuffing in the survival goodies is basically out of the question. (Note: The newer velcro G-suit cannot be worn on the inside of the VWS because it has a soft hose design.)

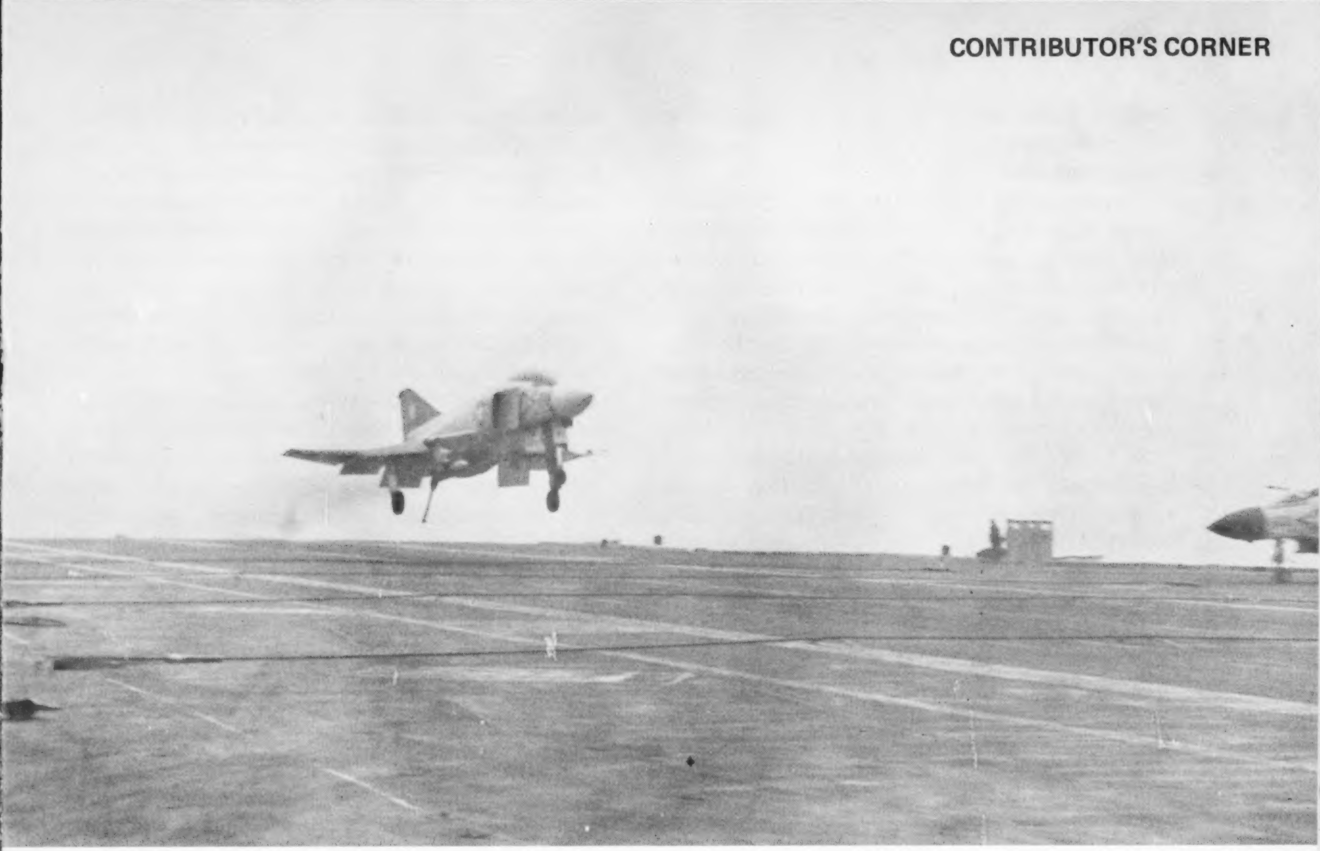
What TACAIR needs is a new antiexposure/antiblackout combination coverall that provides for cockpit freedom of movement and environmental protection.

You can tell the fighter pilot, but he will tell you that what he currently dons for winter, over-the-water, high-G flying just does not hack the program. The attack crews will even back up his story. Most of the guys who can remember will readily agree that we have come a long way since the Mk-4 "rubber sack." But with our advanced state of man-machine interface technology, it seems that we could effectively put the "G" back in the poopy suit rather than having to send Moses back up the mountain to have the tablet rewritten.

Can we not redefine our specifications? Or just plain start all over again? Either course of action must have a single goal: Maximize our performance, subject to minimum crew constraints.

Let's get the "G" back where it belongs so we can really live with the Good Book.

Your UR can help.



"Roger, Coupled Ball"

By LCDR T. A. Myers
NATC, Patuxent River

EVER since an F-3D *Skynight* completed the first automatic Mode I ACLS (automatic carrier landing system) landing on USS ANTIETAM in 1957, the Navy's ACLS has been the subject of a profusion of articles, messages, briefings, and bar talk. It's been praised as the savior of those "black and rainy nights," while others, braver perhaps, have called the system "unnecessary," "too expensive," and "impossible to maintain." What's the real story? Is the system as precise and reliable as it's ever going to be? Is it worth the thousands of man-hours required to maintain it? What are the program objectives? These questions and many more get asked every day. As inflation grows and cuts in the proposed RDT&E budget are becoming reality, these questions must be answered.

The Naval Air Test Center, Carrier Systems Branch, Strike Aircraft Test Directorate, is the working level responsible for ACLS certification of ships, shore stations, and individual types of aircraft. The current list of Mode I (automatic touchdown) capable aircraft include the F-4, RA-5C, and A-7 series airplanes, with the S-3 and F-14 approaching their shipboard phase of testing and the A-6E and EA-6B just beginning their initial development.

The initial development of a Mode I capability requires an extremely thorough study of airplane dynamics and control systems. Simulator and flight test data are utilized to determine if the airplane closed-loop response is adequate to respond to ACLS computer commands. Modifications to the production aircraft AFCS and APC systems may be required to improve approach performance. The SPN-42 computer software program must be designed, checked, optimized, and verified. Once this program is proven in the shorebased testing, the airplane moves on to Phase II – validation of system performance in a carrier environment. These "proof of the pudding" trials may involve one or many trips, depending on the correlation of performance data

with shorebased testing. When this phase of testing is successfully completed, the aircraft joins the growing "stable" of Mode I capable aircraft.

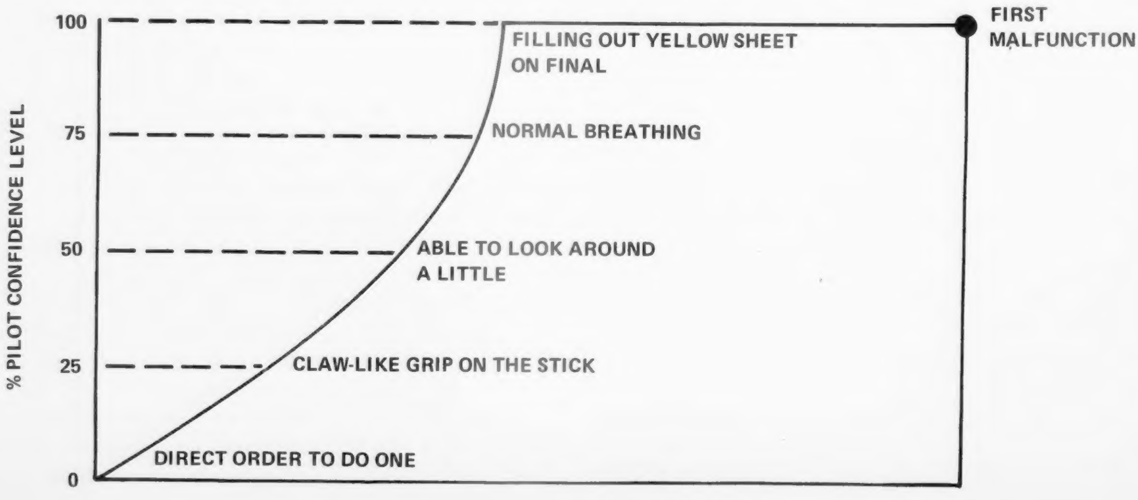
Because of the unique hull and deck designs, the various aircraft deck loadings experienced, ship's trim and mistrim conditions, ACLS antenna locations, equipment status, and, it seems, time of day, each ship must have its SPN-42 computer program customized for each airplane. A ship or shore station certification or recertification is required whenever a new or reworked piece of ACLS equipment is installed that can affect the system's alignment.

The initial shipboard alignment must be performed at pierside in order to minimize errors due to ship's motion. A complex series of tests are completed by NESTED (Naval Electronics Systems Test and Evaluation Detachment) personnel to ensure proper system operation, data flow, crosstalk with NTDS computers, and alignment. Flight tests are then undertaken utilizing a helicopter with a specially designed instrumentation package and an optical theodolite set up on the landing area centerline. Following successful completion of these tests, a series of fixed-wing Mode IA approaches are made with the ship still alongside the pier. The purpose of these flights is to allow the NESTED system checkout personnel adequate time to troubleshoot the system, perform required maintenance, and correct any discrepancies prior to underway flight tests.

With the availability of carrier deck time becoming more critical and the requirements more numerous, one of the most frequently asked questions is whether there is any way that the ship can be certified without requiring all the aircraft to flight check the system. With the current state-of-the-art ACLS, the system's challenge is to control three different types of aircraft, with dissimilar flying qualities, in varying wind conditions, to a moving deck in marginal weather, with safety, and instill a high degree of pilot/crew confidence. This is the task as set forth in the Military Specification for procurement of the system. How does ACLS measure up? Can it hack the program? The answer is a qualified "sort of." The ACLS program is "customized" for a given set of normal operating conditions and then is flight checked to as wide a range of conditions as possible during the certification. The list of items that affects the performance of the ACLS system is almost endless. The obvious ones are the amount and type of deck motion, WOD, turbulence, and burble. The not so obvious ones are ship's trim, APC setting, AOA calibration, wind direction, deck loading, radar beacon range error, aircraft AFCS status, ship's inertial system status, and even the helmsman's steering when chasing the wind. Trash over the fantail seems to be the only thing that does not affect system performance.

How can the ACLS program compensate for all these variables and possible combinations? The fact is, it can't! During an ACLS certification, the SPN-42 ACLS program is modified to give satisfactory performance over as wide a range of variables as possible. This is a compromise! In plain language, the program is optimized at one particular set of conditions and is degraded in any other. One of the primary reasons for a flight check during a ship's certification procedures is to get a sufficient number of touch-and-go Mode I landings to be confident the system will, under all conditions of the clearance limit, land you in the wires and within the strict performance limits of the centerline, aircraft sink rate, and attitude.

Now comes the important questions. Who wants a three-wire, onspeed, lined up, *OK* night pass? Everyone wants their pass to be better than they can do



themselves. Can you count on ACLS doing that for you 100 percent of the time? How fallible is ACLS? Will it drive you onspeed into the ramp? It is fallible, and it can get you to a position in which only you can prevent an accident from occurring. One should be reminded that the ACLS system is only a combination of the ever-popular "black box." Remember, also, the last time you had a TACAN or radio failure – probably just when you wanted it most. In order for this automatic landing aid to work properly, the SPN-42 ACLS data link, aircraft AFCS, APC, and several operators must work exactly right all the way to touchdown. The aircraft or SPN-42 can decide on its own logic that something is out of tolerance or out of limits, pull out, and wait for the next aircraft. This can occur anywhere during the approach, with the in-close positions being the least desirable for the pilot. Now, perhaps, the thought may be creeping into your mind,"Why, in my right mind, would I let myself in for something like this?"

Why make Mode I approaches? The answer is almost a paradox in itself. "SAFETY!" The one factor that stands far above the desire for a zero/zero capable task force and the no-bingo operational commitments is *SAFETY.*

Think back on your last night carrier approach (if you dare!). Even if it was yesterday, it's a good chance you don't remember much in detail about it, unless it was particularly hairy or a rails pass to an OK 3. During the approach, the average carrier pilot is almost 100 percent involved with the pure mechanics of the approach – the change of flap/gear configurations, trim changes, precise altitude airspeed, AOA control, ball and lineup control, radio calls, fuel Bingo, etc. The mechanics are mostly an automatic eye/hand/feet/mouth coordination. The pilot is reacting to what his eyes see, what he hears, and that gut feeling. This is particularly true during the final glide slope portion of the recovery.

Now what does ACLS do for you that makes it any better, considering all the variables and the "must go rights." The answer is "conscious thought time." With the busy mechanics of the approach taken out of his hands, the pilot becomes a real time monitor, a *SAFETY* observer. He has the time to consider how the approach is progressing.

During the manual approach, the cast of characters in the recovery drama consists of the pilot (the hero), the LSO (the critic), the ramp (the villain), the wires (heaven), and the air boss (the producer). During the automatic approach, everything remains the same except the pilot becomes the critic as well as the LSO, and the SPN-42 ACLS becomes the electronic hero. The personnel involved with the real time critique of the pass have increased by 100 percent. What's more important,

the person most capable of effecting the safe recovery of the aircraft is an active critic as well.

What are other advantages of ACLS? For a few intrepid aviators, the night carrier landings were always a series of vertical and horizontal sine waves that arrived in the wires only after a great deal of prayer and promises of not doing "something" ever again. The coupled night approach may be the first time he has seen the deck lined up and in the perspective that it should be seen. Will the pilot become rusty because he doesn't perform periodic manual approaches? Fleet RA-5C reliance on APC as a normal approach mode does not seem to affect the occasional required manual approach. The ACLS is a training aid – and a good one at that.

Okay, you're convinced now on the good aspects of ACLS – where are the pitfalls, the "gotchas"?

First one: *Overconfidence* in the system to land you this time no matter what. Known as the "George has it syndrome." You must be ready at any time to take control of the pass and either continue manually or wave it off. Never allow the system to put you outside of your personal safety performance limits! Read that sentence again.

Second one: *Lack of knowledge* of the status of the approach. For example, you had the HUD turned down on the A-7 and didn't see the head up system waveoff come on. Or you were unconsciously getting a tighter grip on the RA-5C stick in close and accidentally uncoupled it without noticing the D/L uncouple light on. Or the APC disengaged or AFCS uncoupled without you seeing the warning lights. Or the E-2 launching off the No. 2 cat really increased the burble that the system was not customized for. Or possibly the CATTC operator had the wrong type aircraft selected on the ACLS console. There are numerous situations that can develop that can cause you to uncouple or exceed the approach limits of the system. These situations you must be ready for – throughout the approach.

The reliability of the aircraft/ship's equipment varies from Air Wing to Air Wing and coast to coast. If the Air Wing pushes for up aircraft systems and continues to utilize the systems aboard ship for recoveries, chances are it will be an asset to the operational capabilities of the Ship/Air Wing Team. If the ship's SPN-42 equipment is CASREP for a long period of time, the aircraft's equipment tend not to be exercised or maintained, and so the "O/O" or "not available" entries start showing up on the monthly ACLS reports.

Future improvement is expected. At the writing of this article, NASA AMES Simulation Facility is being utilized by NATC to conduct studies on the A-7E ACLS programs to determine what changes will make it more precise and predictable. SPN-42 equipment changes designed to increase the rate at which all ACLS airplanes receive commands are being installed to smooth out the approach as they become available. New F-4 APC configurations to give more precise and timely power responses for ACLS were evaluated in February on USS JOHN F. KENNEDY and new AFCS configurations for improved aircraft response are under evaluation at NATC. The feasibility of using DLC (direct lift control) for ACLS in the F-14 and S-3 is being studied. Larger antenna dishes for field installations are presently being flight tested at NATC in order to improve in-close touchdown at distance points around the various field installations. Evaluations, ideas, suggestions, and changes are constantly taking place. It is anticipated that ACLS recoveries will become much more commonplace in the carrier operations of the future.

The numbers of successful Mode I and IA approaches to a ship or shore station must number in the 50,000 to 100,000 range now without a recorded major accident known to be caused by the SPN-42 system.

So what do we have – hands-off landing – fact or fancy? They had better not make a thickness gage thin enough to get between your hand and the stick and throttle. The system should be entitled "Pilot Monitored, Automatic Landing." The pilot is alive and well and living as a safety critic in the cockpit.

Roger, coupled Ball!

Bravo Zulu

LT Doug Bond
Catapult Officer
USS INDEPENDENCE

WHILE at sea aboard USS INDEPENDENCE, LT Doug Bond refused to launch a tanker-configured A-7E from the waist catapult at a gross weight of 32,000 pounds, although both visual and written confirmation had been received from the pilot that the aircraft weight was correct.

The pilot confirmed over the radio that his weight was 32,000 pounds. Again LT Bond refused to launch the aircraft and asked for confirmation on the fuel status of the aircraft's external tanks. At this time, the pilot changed his weight setting to 37,000 pounds and was launched at the correct weight.

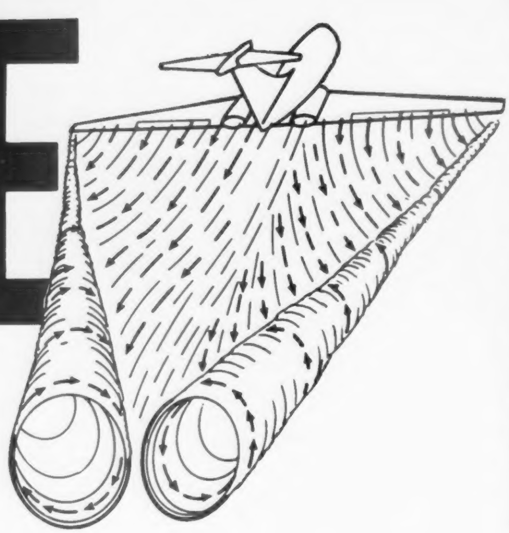
Only through LT Bond's knowledge of the aircraft, attention to detail, and his steadfast refusal to assume what he didn't know for sure, was the launch completed successfully. Through his direct action, LT Bond probably saved the Navy a $4,000,000 aircraft and, very likely, the life of the pilot.

Well Done!

It's a pleasure to cite a catapult officer for outstanding performance because so often he performs his demanding, fatiguing, and critically important work without recognition. LT Bond can be justifiably proud of his personal contribution to aviation safety. Surprisingly, the error he detected was not as isolated as one would think. Over the past 5 years, two other aircraft have been launched, apparently by cat officers not as alert as LT Bond, at incorrect weight settings, resulting in two lost aircraft and one fatality. There have been numerous close calls – and the pilots are usually major contributors to such incidents. A catapult officer can hardly be held accountable if he doubts the weight-board checker, questions the pilot, and receives "verification" of an incorrect gross.

Although there is no established tradition, we'd say this pilot owes LT Bond a bottle of selected spirits. – Ed.

WAKE UP



to wake turbulence or horizontal tornadoes

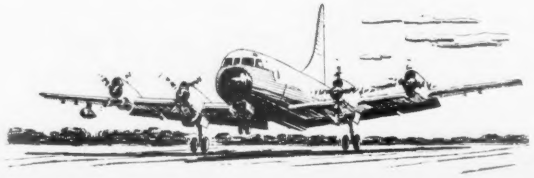
A T-28B was cleared to land, No. 2 behind an E-2. Approaching the threshold, the pilot encountered violent wake turbulence. He cobbed the power to go around as his aircraft rolled into a 90-degree bank. Yet, despite full opposite aileron and full power, the bird struck the ground completely out of control.

A CH-53 and a P-3 were cleared to land on the same runway. (The helo's pattern was well inside of the P-3 and off to the left edge of the duty runway.) The P-3, at 75 feet above the runway, was suddenly thrown into a hard left-wing down attitude. The pilot went to full bore and full opposite aileron and was able to wave off without touching down.

A T-39 was cleared to follow a DC-10 for landing. The pilot was advised of possible wake turbulence. At 450 feet AGL, 2 miles from the threshold, the T-39 rolled violently (about 120 degrees), recovered momentarily, then rolled violently again to the same position. The aircraft impacted the ground, but the pilot was able to level the wings just as he hit, and survived.

Despite increased knowledge and publicity about wake turbulence, accidents and near accidents like these continue to occur. In one of these accidents, a mishap board pointed out in their findings, "The aircrew had limited . . . knowledge of wake turbulence effects." The same board, in their recommendations, said, "An intensive education program should be initiated to better inform aircrews on the cause and effects of wake turbulence."

There are two producers of this phenomenon; thrust stream turbulence (jetwash) and wingtip vortices. The former is caused by the high-velocity air from the props or jet exhaust and is of primary concern during ground operations. It does concern a pilot in the air if he's in close formation, or near the ground during landing or takeoff. Wingtip vortex is an inflight phenomenon caused by a lift-producing airfoil. The circulation of air and the downwash effect of the airflow over the wing causes the air leaving each trailing edge (or rotor tip) to form a vortex flow which rolls itself up into a swirling spiral of disturbed air behind the wingtips. After the rollup is completed, the wake consists of two counter-rotating vortices; in effect, two horizontal



tornadoes. This is the type of wake turbulence that is the real killer.

The strength of the vortex is governed primarily by the weight, speed, and shape of the generating aircraft's wing. The basic governing factor is weight, with vortex strength increasing with weight and span loading.

Trailing vortex wakes have certain characteristics which help a pilot locate and avoid the disturbed air. The wake begins with aircraft rotation on takeoff and ends when the nosewheel touches down on landing.

Tests with heavy aircraft have shown that vortex core diameters range from 25 to 50 feet, but the field of influence is larger. The vortices stay close together (about three-fourths of the wingspan) until dissipation, or until they are influenced by ground contact. In view of this, a slight lateral change in flightpath will usually avoid it.

Tests have also shown that the vortices start to sink immediately at about 400-500 fpm. They tend to level off around 800-900 feet below the generating aircraft's flightpath. Vortex strength diminishes with time and distance behind the generating aircraft, and atmospheric turbulence hastens the breakup. *Pilots should fly at or above the heavy's flightpath and alter altitude and heading as necessary to avoid the area directly behind and below the generating aircraft (Fig. 1).*

When the vortices sink into ground effect, they move laterally outward across the surface at about 5 knots. A crosswind component will decrease the lateral movement of the upwind vortex and increase the movement of the downwind vortex (Fig. 2). This results in the upwind vortex remaining in the touchdown zone a little longer. Conversely, the drift of the downwind vortex is hastened toward a parallel or crossing runway.

The force of the air in trailing vortices can exceed the aileron control capability or climb rate of lighter aircraft. This air can produce roll rates in aircraft with short wingspans up to 80 degrees per second. This is about twice the maximum roll capability of light aircraft. Additionally, an aircraft directly between the vortices of a heavy aircraft can experience a downwash flow of air about 1500 fpm – well in excess of a light aircraft's rate of climb.

Even though most Navy aircraft are relatively heavy and have high roll rates and good climb capability, they are not exempt from the hazards of wake turbulence. A significant number of naval aircraft have been damaged or destroyed in the past as a result of wake turbulence encountered during final approach. Typically, just before touchdown, a wing will drop and contact the runway. The damage varies from just a bent wingtip, to collapsed gear, or complete destruction by cartwheeling.

Just as pilots are cautioned to avoid thunderstorms, the best way to avoid wake turbulence is to stay away from areas where those demon vortices rotate. Perhaps that advice isn't always practical – so what's a pilot to do?

- Pay attention to ATIS or tower reports of "Caution, wake turbulence." Request amplification of the message if you don't see a heavy aircraft on the deck

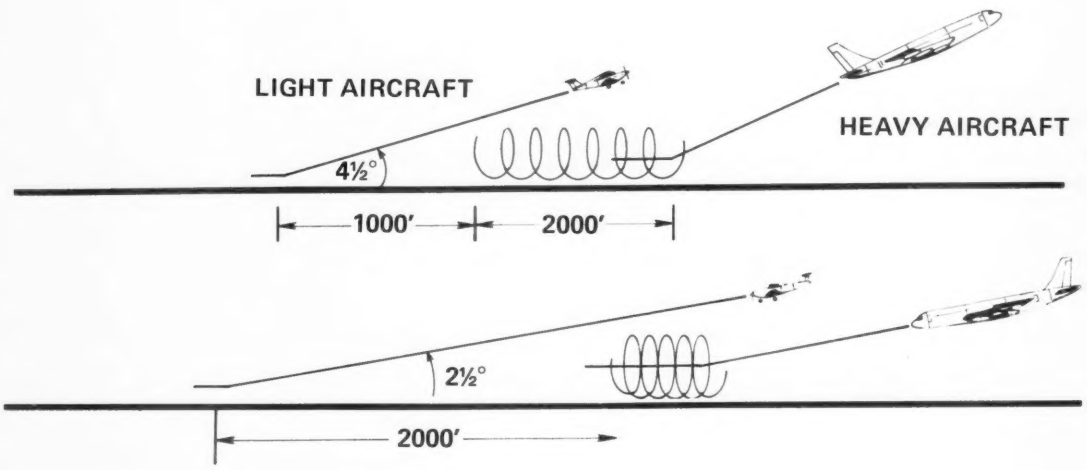


Fig. 1

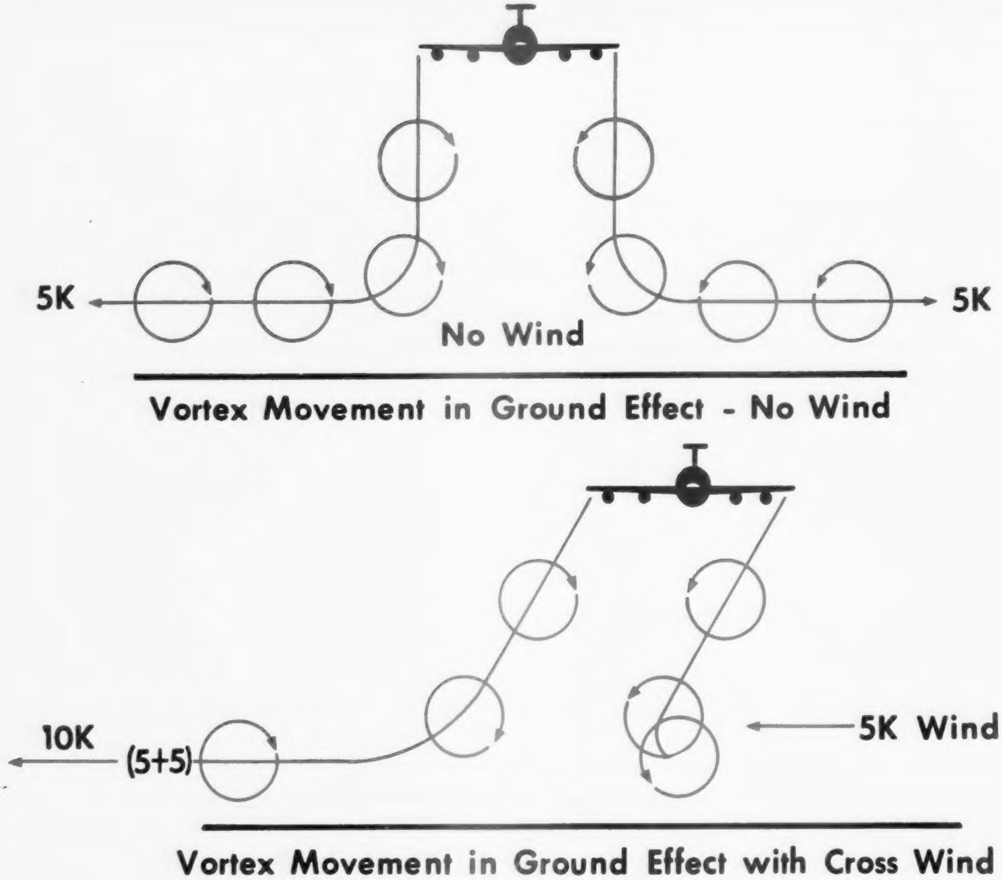


Fig. 2

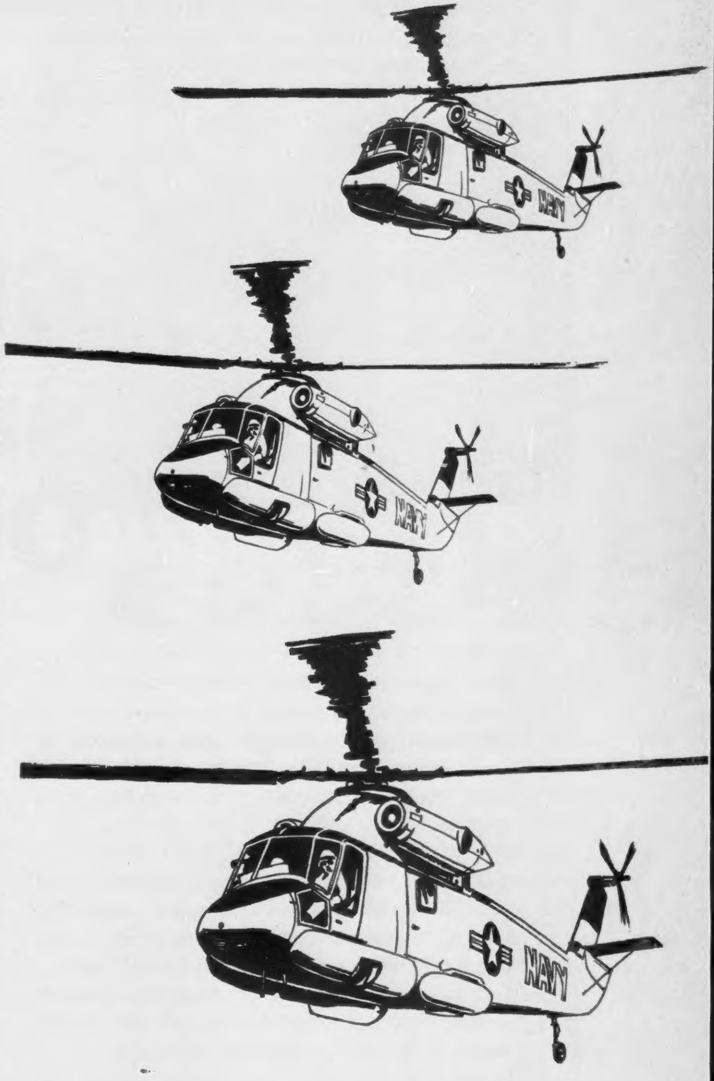
or in the pattern that could affect you.

- Plan your approach flightpath to land *beyond* the touchdown point of a heavy aircraft.
- Plan your takeoff roll so as to be airborne *before* the liftoff point of a heavy aircraft and climb so as to remain *above* its flightpath.
- Recognize that on any approach below and behind an aircraft, you'll encounter turbulence. What you need least is to have a wing drop unexpectedly just about the time you touch down.
- Keep alert when hassling to avoid flying through your adversary's jetwash at close quarters. ◄

A review of back issues of APPROACH discloses that the subject has been addressed in various articles. See "Trailing Vortices" in the FEB '71 issue; "Caution: Wake Turbulence" in MAR '73 issue; and "Close Call," a special Anymouse in the OCT '74 issue.

Recent discussions with pilots at Miramar and Oceana have revealed that the F-14 generates sufficient wake turbulence to cause significant problems for the smaller birds such as the A-4. As a result of this problem, VF-43 at NAS Oceana uses a double interval on landing as a matter of routine. — Ed.

THREE BLIND MICE



IT was a dismal, dreary day, 400-foot overcast, one mile visibility in drizzle, when six not-so-green pilots made ready to fly three helos from the air station to USS BOAT, tied up at the pier about 2 miles away. The reason for the flail was an imminent short deployment.

The pilots hoped to get a special VFR clearance for the short hop, but the flight leader filed IFR, just in case. The brief for the group grope was very casual, but then what problems could be encountered in a 5-minute flight?

They all strapped in, turned up, and awaited clearance. The general feeling seemed to be that even if they had to accept an IFR clearance, they could cancel as soon as they became airborne and saw the ship.

The tower wasn't buying any special VFR and their IFR clearance for the flight of 1/2/3 (?) read "to the 160-degree radial, 10 miles, climb to 1500 feet . . . " There were a few exchanges over the radio as to who would lead. Finally, it was decided that No. 3 would lead. Great. All aircraft took off and were just forming a neat three-plane Vee when lead disappeared into the soup. The other two followed smartly. You guessed it – everyone lost sight of everyone else. On a scale of 1 to 10, the pucker factor rose to 9.5 in each cockpit. Instead of executing normal, inadvertent IFR breakup procedures (not covered in the brief), lead plugged on to the clearance limit, and the other two popped out on top at 2300 feet – somehow managing to avoid each other on the way up.

During this time there was the doggondest exchange of information between the pilots that Departure Control had ever heard. The questions flew thick and fast. "Where are you?" "What heading are you on?" "What's your TACAN?" "What's your altitude?" Everyone sounded like they were auditioning for the Vienna Boys' Choir.

Finally, with the controller's help all three rendezvoused above the clag, and the flight leader assumed the lead. What next? That's exactly what the controller asked. Slightly exasperated, the controller suggested that maybe they'd like to return and regroup. He thought the PAR route would do the job. In answer to Departure's question, the copilot in lead's aircraft allowed as how a "section" return would be nice, but he didn't consult anyone else. The wingmen watched lead disappear into the clouds, and having learned their lesson on the way up, wanted no part of any more three-plane gaggles. They remained VFR on top, and requested individual precision approaches (to the controller's joy).

Clearances followed, and on base leg each popped out of the clouds and spotted the ship. They apologized profusely to Approach and, with tail pylons tucked neatly between their mainmounts, landed some 30 minutes after takeoff. I can't believe we were so dumb and LUCKY.

Oneofthreeblindmice

Heart attacks in the United States are going down, according to recent press reports. Speculation on the reasons include the widespread publicity on dangers of high fat diets and smoking, and the benefits of regular exercise. In the tradition of "Me Quit, How?", SEP '73 APPROACH; "Reflections on Mortality," MAR '74; and "CO and Smoking," MAY '74, we bring you the following questions and answers on heart attacks and smoking from the American Heart Association:

SMOKING and Heart Disease

Are there more heart attacks among smokers than nonsmokers? In a study of smoking habits of middle-aged men, observed over a number of years, it was found that the heart attack rate in heavy cigarette smokers was twice as high as in nonsmokers.

Are there more deaths from heart attacks among cigarette smokers? In studies of various population groups, it was found that death rates from heart attacks in men range from 50 to 200 percent higher among cigarette smokers than among nonsmokers, depending on age and the amount smoked. The average increase is 70 percent.

Smoking is an added risk for people who are more susceptible to coronary artery disease, such as those with high blood pressure, high blood cholesterol, signs of hardening of the arteries, a family history of heart attacks and strokes in middle age, or a combination of any of these conditions.

Are cigarettes a health hazard for teenagers? Yes, there is enough evidence of harmful effects on the body to discourage smoking even in young, healthy people. Obviously, the earlier you begin to smoke, the greater the risk to your health in future years. You may even risk a shortened lifespan.

Smoking is a habit hard to break. Teenagers who never smoke will never have the problem of trying to do without tobacco.

Does cigarette smoking cause heart disease? It has not been proven that cigarette smoking is a direct *cause* of heart disease. However, studies strongly suggest that it contributes to or speeds up the development of coronary artery disease which leads to heart attacks.

What are the effects on the body of substances in tobacco smoke? Tobacco contains nicotine which acts on the heart, blood vessels, digestive tract, kidneys, and nervous system. It also contains minute amounts of tars and other substances which may produce cancer, and irritants which chiefly affect the bronchial tubes. Small amounts of carbon monoxide and arsenic are also present in tobacco smoke.

Ninety percent of the nicotine (and probably other substances in tobacco) is absorbed into the body when smoke is inhaled; 10 percent is absorbed when smoke is puffed without inhaling.

How does smoking affect the circulatory system? In most people who have been tested, smoking makes the heart beat faster, raises the blood pressure, and narrows blood vessels of the skin, especially in the fingers and toes. In normally healthy people, these

changes are temporary and differ in degree according to the individual's response to tobacco. Persons who are hypersensitive to tobacco have the most pronounced reactions.

Why is smoking especially dangerous for patients with disease of blood vessels in the arms and legs (peripheral vascular diseases)? Smoking aggravates their condition because it constricts blood vessels that are already narrowed and damaged. Patients with peripheral vascular disease are strongly warned against smoking, because those who continue to smoke increase their risk of gangrene, amputations, and even death. The effects of smoking are especially evident in Buerger's disease which occurs almost exclusively in men who smoke. This disease affects the small arteries of toes and fingers in early stages, but may later involve larger blood vessels. When the patient stops smoking, the condition almost always is arrested, but a return to smoking causes it to recur.

Smoking is also dangerous for patients with atherosclerosis (hardening of the arteries) of the extremities, a disease which interferes with the circulation in legs and feet.

What other serious diseases appear frequently in smokers? Lung cancer appears much more frequently in cigarette smokers than in nonsmokers. A number of statistical studies indicate that cigarette smoking is the chief explanation for the increase in lung cancer since 1920. Studies have also shown that chronic bronchitis and emphysema (a destructive disease of the lungs) are often associated with smoking. Abnormal tissue changes related to these diseases have been observed in the lungs and bronchial tubes of heavy cigarette smokers.

Even young smokers sometimes develop a chronic cough. It is believed that a "cigarette cough" may predispose a person to emphysema or to the more serious forms of bronchitis.

How is emphysema related to heart disease? Emphysema, a chronic disease which makes breathing difficult, may result in heart failure. Smoking aggravates emphysema. In nonsmokers who develop emphysema, the disease is apt to be less severe.

Are there other effects on health from smoking? Tobacco may cause reactions in the stomach and intestines which affect normal digestion or make gastrointestinal disorders become worse. Smoking appears to slow down the healing of gastric and duodenal ulcers and tends to make them chronic. In some other digestive problems, symptoms may be relieved when smoking is stopped.

How Does Smoking Affect Aviators?

ALL aviators should understand the effects of carbon monoxide obtained from smoking. The affinity of human hemoglobin for carbon monoxide is 200 times its affinity for oxygen. An aviator who is a heavy smoker can get as much as 10 percent carbon monoxide hemoglobin saturation. Only 3 percent is sufficient to cause measurable impairment of functions such as vision and altitude tolerance. The effects of carbon monoxide on vision are particularly serious. Smoking three cigarettes in a relatively short period before takeoff will reduce the night vision of a pilot as much as the effect of 8000 feet of altitude.

USN Flight Surgeon's Manual

Is there any risk in moderate cigarette smoking? All cigarette smokers run extra risk of coronary disease in proportion to the number of cigarettes smoked. Heavy cigarette smokers have higher death rates from heart attacks than moderate smokers. According to present evidence, smoking pipes and cigars does not increase the risk of heart disease as does cigarette smoking.

Why is there less risk of heart disease among pipe or cigar smokers? Probably because the pipe and cigar smoker usually does not inhale.

How effective are filtered cigarettes? Most filters now in use reduce only moderately the amount of harmful substances in cigarette smoke. So far, there is no evidence that filters are the answer to "safe" smoking.

If you have been a heavy smoker, does it help to stop? Yes, because the death rate from coronary artery disease decreases among those who give up smoking and, after a period of years, approaches that of people who never have smoked. Also, in individuals who stop smoking, abnormal changes in body tissues – such as occur in the lungs or bronchial tubes – gradually revert toward normal.

BEWARE the Reflections

By CAPT Howard M. Hoffman, USMC

ABOUT this time last year, what began as a routine night instrument hop in a UH-1E became a near crisis when the pilot rapidly developed severe vertigo. Luckily, he recognized his predicament in time to hand over the controls to the copilot.

There had been nothing particularly unusual about the pilot's day. After a good 8 hours sleep, he had arisen feeling rested. His office routine was relaxed – no big problems, and he ate three good meals that day.

At 1715, he reported to the readyroom for a 1720 brief. His scheduled copilot was stationed with a ground unit 18 miles from the airfield. The pilot briefed to launch single-pilot and pick him up at the unit landing zone. The brief was thorough with special instructions for use of lights:

Start: Flashing bright, beacon off.

Taxi and takeoff: Steady bright, beacon on.

Landing: Flashing bright, beacon off.

Preflight and start were normal. The pilot put external lights on steady bright and turned on the rotator prior to taxi. Takeoff was normal as was the VFR flight to the landing zone to pick up the copilot. After the copilot strapped in, the pilot briefed him on conduct of the flight and discussed crew duties in the event of an emergency. He gave the copilot the aircraft for takeoff.

They flew VFR for about 45 minutes before contacting a GCA unit and requesting multiple approaches. As briefed, the crew chief shifted to the right side of the aircraft as the pilot went on the gages to commence the first approach.

As soon as he went on instruments, the pilot noticed an intermittent light source at the one o'clock-high position. He looked up and commented to the copilot that the reflection of the green starboard position light off the rotor disc was unusually bright. Back on the gages, he began to feel uneasy while turning base leg.

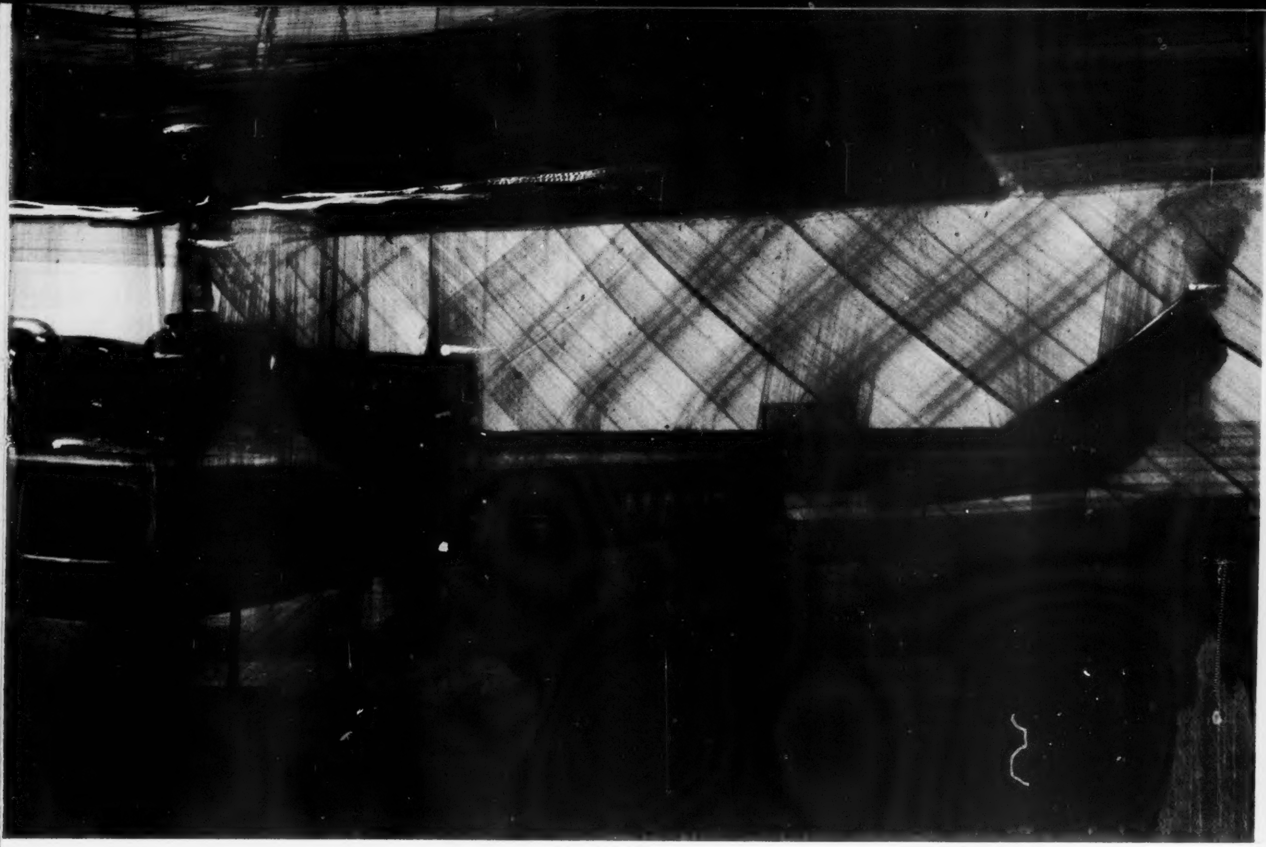
Once established on the glide slope, the HAC experienced difficulty with his scan. When he executed a prebriefed missed approach at one-half mile, he realized that a well-developed case of vertigo had set in. First, the disoriented aviator couldn't recall the simple missed approach instructions: turn right to 110 degrees, climb to and maintain 1000 feet. He asked the copilot to confirm the heading/altitude instructions as 060 degrees and 1500 feet. Second, nose attitude control had not been up to par during the approach and was now deteriorating rapidly as was heading control. Third, he felt nauseated and dizzy. In less than 5 seconds, he had gone from controlled flight to severe vertigo.

Although preliminary indicators had existed unrecognized, the onset of vertigo had been extremely rapid. Fortunately, the copilot was well qualified and was able to take control without difficulty when the pilot, attempting to execute the missed approach, told him to take the aircraft.

Once the pilot recognized his precarious state, he passed the controls and attempted to eliminate the cause of his vertigo. His first step was to gain an outside visual reference. This markedly reduced the vertigo's severity and resulted in his decision to continue the mission. Since other aircraft were in the area, the pilot did not consider it prudent to secure external lights, but he did dim them. This also helped.

A full 30 minutes passed before the pilot felt normal again. The copilot continued the GCAs, while the pilot remained visual. The rest of the flight was without incident.

When the pilot returned to the readyroom, he briefed the other night fliers on his experience. He found that,



although exposed to nearly the same circumstances, none of the other pilots had experienced the same difficulty.

Some weeks before, a corrosion problem with the UH-1E rotor blades was discovered. One of the measures taken to minimize the probability of corrosion was to wax the blades. Evidently, waxed blades reflect more light than nonwaxed blades, constituting a flicker-induced vertigo hazard for pilots susceptible to this type of spatial disorientation.

A physical examination by a flight surgeon failed to show anything which could possibly have caused the vertigo. In addition, the symptoms described more closely resemble those of flicker vertigo than movement-induced vertigo. As explained by the flight surgeon, the reflected light from a UH-1E rotor blade in normal operation – 9.8 to 10.8 reflections per second – is precisely within the range associated with flicker vertigo.

(A steady light flicker, at a frequency between approximately 4 to 20 per second, can produce unpleasant and dangerous reactions in normal subjects, including convulsion, nausea, unconsciousness, or vertigo, the Flight Surgeon's Manual states. The exact physiological mechanisms underlying such reactions are not known. – Ed.)

Introduction of only a few variables on this particular night flight could have produced traumatic results. Consider what might have happened in the case of entry into actual IMC or if IMC had been encountered prior to copilot pickup. Suppose the copilot had been unqualified – or the vertigo had continued unrecognized until convulsions resulted?

What can be done to preclude a reoccurrence?

Annual physiological training is not enough. Every advantage must be taken of AOMs, safety standdowns, back-in-the-saddle programs, and weekly visits to the squadron area by the flight surgeon. We must continuously encourage use of Anymouse and Op Hazard Reports to pass information affecting safety of flight. And we must make sure that a responsive line of communication between the "users" and the "designers" remains open.

What about it, flight surgeons, aviation safety officers, and commanding officers? Are your pilots familiar with the indicators preceding vertigo, no matter what the inducement? If any one of your pilots had been the pilot in command on this flight, would the aircraft have come home? Or would you and your AAR Board have been forced to retrieve it?

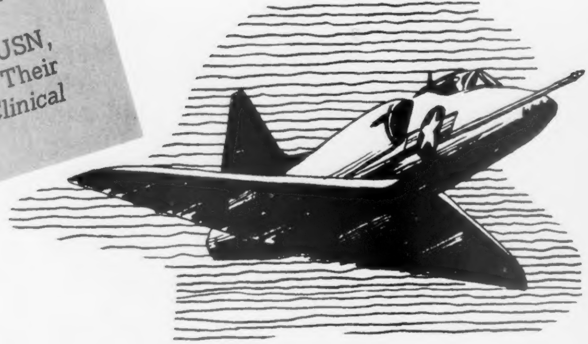
Learn from this experience.

It could save lives.

1 July 1975

MEMORANDUM

From: Aviation Psychologist, Naval Safety Center
To: Director, Aviation Safety Programs, Naval Safety Center
Subj: Psychological Profiles on LT "Hot Shot," USN, and CAPT "Eager Beaver," USMC
Ref: (a) "Accident Proneness in Aviation" by CAPT Roger F. Reinhardt, MC, USN (Ret.), Texas Medicine, Vol. 62, No. 11, pp.75-78, Nov 1966.
(b) Review article by CDR R. H. Rahe, MC, USN, "Subjects' Recent Life Changes and Their Near-Future Illness Reports," Annals of Clinical Research 4: 250-265, 1972.



psychological profile

By R. A. Alkov, Ph.D.
Naval Safety Center

1. On a clear summer morning in the desert, LT "Hot Shot," flying an A-7E at an estimated 300 feet AGL and 300 knots, commenced a left turn after passing over the bombing range on a computer update run. The left roll continued at a constant rate. The aircraft impacted the desert inverted. There was no apparent attempt to eject.

2. Two weeks later, on another clear summer morning, in the same desert, CAPT "Eager Beaver" flew an A-4F into the ground on a low-level competitive exercise. There was no apparent attempt to eject.

CAPT Beaver had been assigned by the Wing to fly as safety observer with another squadron. The ops officer of his parent squadron stated that "CAPT Beaver was a good stick and throttle pilot but at times showed a lack of judgment and made headwork mistakes. For these reasons, he was not qualified as a section leader and normally flew with our senior or second tour pilots." CAPT Beaver's overly aggressive approach to low-level flight bordered on the unsafe. On a prior low-level flight, he was informed that he appeared to be only 25 to 50 feet AGL. He was told that he would fly his next low-level flight with the operations officer to demonstrate proper conduct of the flight. Without the knowledge of the ops officer, however, he was assigned to fly with another command. The ops officer had not informed the CO or the Wing of CAPT Beaver's dangerous tendencies because he considered him to be in a training status.

3. Psychological profiles completed on LT Shot and CAPT Beaver reveal many similarities between the two cases. These similarities fit the personality profile of the accident-liable aviator outlined by Dr. Reinhardt in reference (a). Both aviators were considered to be good stick and throttle jocks. Indeed, their training command grades placed them in the top of their respective classes in academics as well as in flying. In fact, both were selected for the master's degree program in Pensacola.

4. Both pilots were action-oriented, aggressive, impulsive, independent, and adventurous. (This description fits the personality profile described by Dr. Reinhardt.) Both were the kind of individuals who would impress their flight instructors and thus be selected for high performance combat aircraft.

5. Interviews with close friends of LT Shot disclosed that he had recently undergone a number of life crises starting with the death of a friend in an aircraft accident. He had considerable financial problems and was on the verge of bankruptcy in his real estate dealings. Just back from leave in his hometown, he became engaged to his girlfriend. He had had several arguments with his father during his leave. As a result of all of these life changes, he had become depressed, according to his friends, and was secretly consulting a civilian clinical psychologist about his depression.

6. A background survey on CAPT Beaver's personal life revealed that he had undergone 567 life change units

in the past year. These included a marital separation, divorce, death of a close friend, vacation, change in residence, and added financial responsibilities (see Table 1). Three hundred and seven of those units occurred in the past 6 months. Research at the Navy's Medical Neuropsychiatric Research Unit in San Diego revealed that people with over 300 such units have more than a 70 percent chance of becoming physically ill or injured within a year (ref b). *(See FEB '75 issue of APPROACH. – Ed.)*

TABLE 1

Rank	Life Event	Mean Value
1	Death of spouse	100
2	Divorce	73
3	Marital separation	65
4	Jail term	63
5	Death of close family member	63
6	Personal injury or illness	53
7	Marriage	50
8	Fired at work	47
9	Marital reconciliation	45
10	Retirement	45
11	Changes in family member's health	44
12	Pregnancy	40
13	Sex difficulties	39
14	Gain of new family member	39
15	Business readjustment	39
16	Change in financial state	38
17	Death of close friend	37
18	Change to different line of work	36
19	Change in no. arguments with spouse	35
20	Mortgage over $10,000	31
21	Foreclosure of mortgage or loan	30
22	Change in work responsibilities	29
23	Son or daughter leaving home	29
24	Trouble with in-laws	29
25	Outstanding personal achievement	28
26	Wife begins or stops work	26
27	Begin or end school	26
28	Change in living conditions	25
29	Revision of personal habits	24
30	Trouble with boss	23
31	Change in work hours, conditions	20
32	Change in residence	20
33	Change in schools	20
34	Change in recreation	19
35	Change in church activities	19
36	Change in social activities	18
37	Mortgage or loan under $10,000	17
38	Change in sleeping habits	16
39	Change in no. family get-togethers	15
40	Change in eating habits	15
41	Vacation	13
42	Christmas	12
43	Minor violations of the law	11

7. CAPT Reinhardt concludes that a hypothetical profile of the accident-liable aviator would include these factors: (a) a strong moral upbringing resulting in a strong drive for independence matched by an equally strong conscience; (b) he is action-oriented; (c) he places great importance on his appearance in the eyes of others; (d) he has recently assumed major new responsibilities (CAPT Beaver recently purchased a new home and assumed new duties); (e) the symptoms of the "accident process" are manifested by errors in all areas of living – personal (such as divorce), social, and professional; and (f) he senses something is going on, and his actions are a disguised plea for help (such as flying dangerously low in the presence of the ops officer). CAPT Beaver and LT Shot fit every aspect of this profile as if CAPT Reinhardt was writing about them personally.

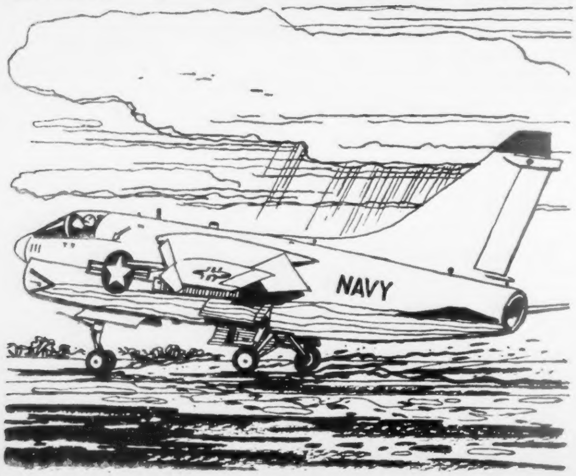
8. In summary, these two aviators were perfectionists who expected a lot of themselves. They habitually pushed themselves to their limits in flying as well as all of their other activities. In other words, they regarded themselves as "winners."

When such a person runs into a number of personal problems, he becomes disillusioned with his own ability to cope with his personal life situations. Used to being on top of the situation, he feels depressed when he discovers he is as human as everyone else. In this depressed state, he pushes his flying to his personal limits, as usual. But, because of the fatigue and lowered mental and physical reactions associated with the depression, his limits are exceeded. He makes a mistake, and a mishap results.

9. My conclusion is that these accidents contain significant supervisory error on the part of the flight surgeons, squadron operations officers, and COs and significant supervisory error at the Air Wing level for allowing these aviators to be scheduled for unsupervised flights.

10. Although each aviator is an individual with his own unique coping ability (so not all will be affected the same way), those who *are* having personal problems should be made aware of the hazards. Also, their COs should ensure that the performance of these pilots is closely monitored to detect any adverse effect. This information should be made available to flight instructors, safety officers, COs and XOs, flight surgeons, and operations officers.

Severe Weather



DURING the period FY-69 through FY-74, there have been a total of 202 fixed-wing mishaps (accidents and incidents) in the Continental United States in which severe weather was a factor. This included 13 aircraft destroyed, 3 substantially damaged, 5 minor damage, and 140 limited damage. The remaining 41 aircraft received damage so minor that it was classified as "none."

There were 87 cases of damage by lightning, 85 by hail, 24 by icing (primarily broken windscreens from faulty heaters), and 18 by rain erosion on radomes and intake lips, notably on A-7 and A-6 aircraft. (Note: Some of the aircraft received more than one type of damage.)

Figure 1 gives a brief description of the circumstances surrounding the mishaps where aircraft were destroyed

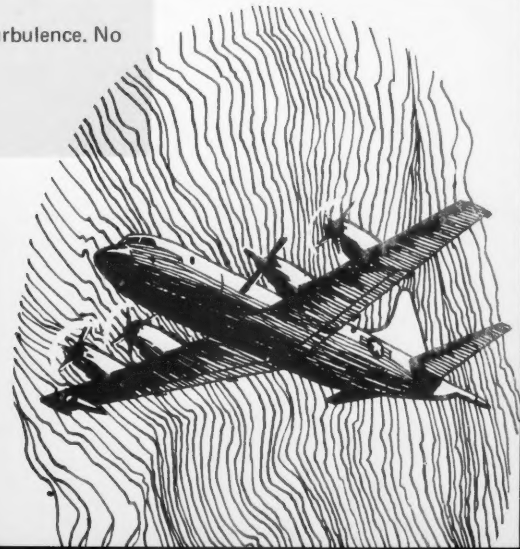
Aircraft Destroyed

TF-8A	Acft at FL420 in vicinity of thunderstorm activity experienced compressor stall, then flameout. Relight unsuccessful, pilot ejected. No injury.
TF-8A	Acft climbed from FL420 to FL480 to top thunderstorm. Acft flamed out, pilot descended into clouds, became disoriented, ejected. No injury.
F-8H	Pilot flying through saddleback between two mountains, at 200-500 feet and 450-600 knots. Wing came off. No ejection. Fatality.
EKA-3B	After takeoff, during climb, at FL235, aircraft pitched up while in clouds in vicinity thunderstorms. Suspect frozen slats causing aircraft to go out of control. Crew bailed out. One major injury.
F-8K	Pilot entered thunderstorm at FL370. Suspect stall/spin, disorientation. Pilot ejected too late. One fatality.
T-2A	Iced up on GCA approach, stalled. Student ejected. Instructor remained in aircraft. One fatality.
T-28B	Student recalled to homefield (in formation flight). Approaching break, entered clouds, became disoriented. Crashed into building. One fatality.
U-11A	Entered thunderstorm. At 3000 feet, severe turbulence, heavy hail, darkness. Pilot elected to crashland in open field. One major, 2 minor injuries.
F-4B	Pilot enroute to FCLP, flew into cumulus type clouds at 2000 feet. Went into steep nosedown attitude, crashed into ground. Suspect disorientation (occulogravic illusion). Two fatalities.
OV-10A	Entered icing enroute. Lost airspeed indicator, entered unusual attitude, pilots ejected. One major, 1 minor injury.
A-7E	Pilot used HUD as primary attitude reference during climbout in IFR condition. Became disoriented; ejected. No injury.
P-3A	Acft disintegrated in area of thunderstorms, heavy lightning. Suspect lightning ignited fuel tanks. Ten fatalities.
A-7A	Entered thunderstorm at 5500 feet. Suspect became disoriented, crashed. One fatality.

Aircraft Substantially Damaged

F-4J	Explosion and loss of external tanks while in cirrus clouds, with moderate turbulence and freezing rain. Suspect lightning. No injuries.
TA-4J	Acft received hail damage while in stratus clouds. Experienced turbulence. No injuries.
T-28	Hail in thunderstorm while on cross-country flight. No injuries.

Fig. 1



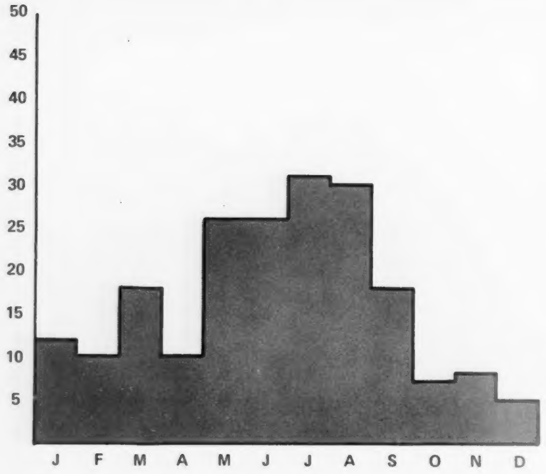


Fig. 2

Fixed-wing aircraft mishaps due to severe weather, during period FY-69 through FY-75, by month of occurrence.

or substantially damaged. Included also are the figures on injuries and deaths. In addition to the deaths/injuries listed in Fig. 1, there were 3 minor injuries in a P-3A resulting from turbulence and 1 minor injury in an A-6 from windblast after hail broke out the windscreen.

Figure 2 is a chart showing mishaps by months of the year. As expected, most of the mishaps occurred during the summer months, i.e., 117 out of 202 mishaps occurred during the 5-month period of May through September.

Thunderstorms. The majority of mishaps involved weather with vertical development, e.g., thunderstorms. It is appropriate, therefore, to review thunderstorm weather. Individual thunderstorm cells are rarely larger than 10 miles in diameter, and their life cycle is normally between 20 minutes and one-half hour in duration. It is very common, however, for thunderstorms to develop in clusters of two or more. Clusters, with individual thunderstorms at various stages of development, sometimes attain diameters in excess of 100 miles and last for 6 hours or more.

Thunderstorms are almost always accompanied by severe or extreme turbulence, icing, lightning, thunder, precipitation, and gusty winds. The more severe ones produce hail and sometimes tornadoes.

Hail competes with turbulence for first place as being the greatest hazard to aircraft. Most, and perhaps all, thunderstorms have hail in the interior of the cumulonimbus cloud at some stage. In a large percentage of the cases, the hail melts before reaching the ground, but this does not lessen its danger to the pilot who encounters it aloft.

Usually, hail is produced during the mature stage of the thunderstorm's lifespan and is most frequently encountered at levels between 10,000 and 30,000 feet. Hailstones with diameters up to 5 inches have been reported at 29,500 feet. The frequency of large hail decreases quite markedly above 35,000 feet. Hail may be found at any level within a thunderstorm, and on occasion, may be encountered in clear air turbulence outside the storm cloud. Hailstones may be thrown upward and outward from the cloud as much as 5 miles under an innocent appearing anvil of cirrus clouds.

Turbulence. All thunderstorms are turbulent, and some are potentially destructive to aircraft. Almost any thunderstorm contains the potential to produce severe turbulence, and the typical large ones may produce turbulence classified as "extreme." Those which create the most severe turbulence are the hail producers. While considerable turbulence may be found anywhere in the thunderstorm, there is less chance for severe or extreme turbulence in the lower levels.

In addition to the possibility of structural damage to aircraft, there exists the possibility of loss of control because of disorientation or improper movement of flight controls. Another factor which accounts for some accidents is the gusty surface winds produced by thunderstorms. This, of course, is primarily a hazard during landing or takeoff.

Lightning. Electricity generated by a thunderstorm can offer a real hazard to aircraft. Although only minor or limited damage was reported in 85 of 87 mishaps involving lightning, it is the suspected cause factor in the loss of a P-3A and the substantial damage done to an F-4J.

Avoiding Severe Weather. * The No. 1 rule is to avoid severe weather if at all possible. Make maximum use of preflight weather briefings and Metro information while in flight. Present FAA ATC procedures provide for controllers to assist pilots in avoiding areas of known severe weather, particularly while operating on IFR flight plans. It must be realized, however, that at times there are limitations to an air traffic controller's capability for providing such assistance. There are several reasons for this. First, the controller's primary responsibility is the safe separation of aircraft. No additional services can be provided which will derogate the performance of this duty. Secondly, limitations of ATC radar equipment, communications congestion, and other air traffic may also reduce his capability to provide additional services.

To a large degree, the help given by ATC will depend upon the weather information available to controllers

* Source: Mr. John Berta, former FAA Liaison Officer, NAVSAFECEN.

and the requests made by pilots attempting to avoid severe weather areas. Because of the transitory nature of thunderstorms, information available to controllers might be of limited value unless frequently updated by pilots in direct communication with controllers. Giving specific information as to affected areas, altitudes, intensity, and nature of severe weather can be of considerable value. When received by controllers, these reports will be relayed to other aircraft as appropriate.

Should avoidance of a weather situation enroute be desired, request a deviation from the route/altitude as far in advance as possible, including information as to the extent of the deviation desired. An IFR clearance to circumnavigate severe weather can often be more readily obtained in the enroute areas away from terminals because there is usually less congestion, and therefore, greater freedom for course deviation. In terminal areas, the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, and adjacent airports. As a consequence, controllers are less likely to be able to accommodate all weather requests for weather detours in a terminal area or be in a position to volunteer such routes. Nevertheless, do not hesitate to advise controllers of any observed significant weather or ask to circumvent it.

Weather echoes observed on radar (airborne or ground) are a direct result of dense precipitation. All radar used for air traffic control purposes is not capable of equally displaying precipitation information. Under certain conditions in the past, echoes received from precipitation have rendered ATC radar unusable. To avoid disruption to radar service, modifications designed to reduce precipitation clutter have been added to radar systems. This feature, known as circular polarization, eliminates all but the heaviest areas of precipitation from the scope. So remember, all areas of precipitation will not appear on the controller's radarscope. Radar, obviously, cannot display turbulence, but it is known that turbulence is generally associated with areas of heavy precipitation.

Controllers will issue information about severe weather observed on radar when advisable and will, upon request, provide vectors for avoidance whenever circumstances permit. For the already mentioned reasons, however, do not completely rely on air traffic controllers to provide this service at all times, particularly in terminal areas or in holding patterns. Also, remember that the controller's data is often far from complete because of design of the radar and its location relative to the weather observed.

In addition to primary surveillance radar, all Air Route Traffic Control Centers and many terminal radar facilities are also equipped with secondary radar systems (beacons). These secondary systems receive only those signals emitted by airborne radar beacon transponders and do not display weather echoes. Since all aircraft operating in positive control areas are required to be equipped with operating radar beacon transponders, controllers handling such traffic normally use only the secondary radar system. This permits filtering out nonpertinent traffic operating below positive control areas. Although controllers using only secondary radar will not see any weather on their scopes, they will, if alerted, often turn on the normal radar to observe weather, provided this does not result in weather clutter, making the scope unusable for traffic control.

Recommended pilot actions include:

- Report to ATC any significant weather encountered, giving nature, location, route, altitude, and intensity.
- Initiate requests to avoid severe weather activity as soon as possible, being specific concerning route and altitude desired.
- Do not rely completely on air traffic controllers to provide information or to initiate radar vectors to aircraft to avoid severe weather, particularly when arriving or departing terminals or in a holding pattern.

Penetrating a Storm as a Last Resort. If, in spite of all precautions, flight in a thunderstorm cannot be avoided:

1. Secure all loose objects in the aircraft and ensure that all persons are securely strapped in.
2. Increase cockpit lighting to highest intensity as a protection against momentary blindness from lightning flashes.
3. Establish penetration altitude. Avoid altitudes from the freezing level upward to -10°C (roughly 5000 feet above the freezing level). This usually is the most severe region of the thunderstorm. The "softest" altitude is usually between 4000 and 6000 feet. Four thousand feet above the highest terrain should be the minimum penetration altitude.
4. Reduce airspeed to NATOPS recommended rough air penetration speeds. Set power to maintain the desired speed before entering the storm and keep constant power settings in the storm.
5. Fly attitude. Altitude and airspeed will vary considerably during turbulence, but better control can be maintained with minimum hazard to the airframe by flying attitude. If the aircraft is equipped with an autopilot, disengage the altitude hold feature during thunderstorm penetration.
6. Pick a heading that will take you through the storm in minimum time and hold it.

Not only the Boy Scouts need to...

Be Prepared

Anonymous

WHILE returning from a low level training mission culminating with a Mk-76 weapon drop, I was marvelling over the incredible full systems capability of the A-7E I had just flown for over 2 hours. I led the section into the break at NAS Cubi Point, confident and pleased with the flight. I broke with the intent to land, but then remembered that my squadron had launched a tanker and wanted me to give the package a check since it had been inoperative on a previous flight.

The weather was clear, and the tanker aircraft was briefed to be overhead, so I cleaned up the aircraft, departed the pattern, and called the tanker on the assigned frequency. The tanker was overhead at 8000 as briefed, so I continued climbing to rendezvous, with approximately 1500 pounds of fuel remaining. The tanker pilot called "Point One," followed by a garbled transmission. After attempting to transmit a request for him to repeat his position, I realized that it was my radio that had failed.

I decided to continue the rendezvous, although I did not yet have visual contact. The low fuel light came on about the same time I obtained a "tally-ho" on the tanker. As the tanker was supposedly capable of giving me up to 3000 pounds of fuel, I rendezvoused and plugged in. It soon became apparent that I was not receiving fuel. Since I had broadcast my fuel state to the tanker pilot prior to radio failure, I was sure he was trying to provide. I backed out and plugged again, but after three or four futile attempts, I concluded that the tanker package was still sour, and suspected that he might also be experiencing problems retracting the drogue.

I now had to change my plans, as I had hoped to take on a sufficient amount of fuel and return for landing with the tanker leading me in as a *nordo*. I was now down to 1000 pounds. I was directly over the runway, so I decided to go in alone in the interest of expediency. After signalling my intention and fuel state to the tanker pilot, I broke off and did an idle descent through the initial, rocked my wings to signal the no-radio condition, and took my own interval on a C-130. Passing 220 knots, I lowered the gear and flaps. Habitually checking the gear down and locked, I noticed that the nose gear indicated unsafe. I cycled the gear twice, but it still indicated unsafe. I cycled the gear one more time between the 180 and the 90 with the same result. I waved off, rocked my wings again, and took my own interval. Recycling the gear one more time, I noticed that when the gear handle was raised to UP, the nose gear indicated up and locked almost immediately. From this I deduced that the nose gear was indeed not extending. Downwind, I tried extending the gear by the emergency air bottle method, but to no avail. Pulling and pushing the nose in an effort to force or shake loose whatever was causing the problem was also futile. Nothing. The nose gear was still unsafe, and I felt quite certain it was actually up. I had 850 pounds of fuel remaining, no radio (not even Guard), and was at emergency fuel. With a good landing interval, I decided to land the aircraft, utilizing NATOPS nose gear-up landing procedures.

I landed the aircraft by flying on speed with a centered ball until just prior to touchdown. At this point, I pulled the nose up a little to grease it on and commence aerodynamic braking. While holding the nose up, I also secured the engine, and when I felt that I was about to run out of pitch control, I released backstick pressure. As the nose started down, I put in full backstick to ease the touchdown. The nose hit the runway with a surprisingly loud scraping and grinding sound. I felt awkwardly low, as if I was sitting on the runway. I had somehow imagined that I would immediately grind to a halt without a tire on the front, but instead found myself skidding along with amazingly little friction. I applied normal braking pressure and stopped the aircraft.

I experienced no directional control problems at all. Upon coming to rest, I looked around for possible fire and, seeing none, calmly opened the canopy. My initial inclination was to wait and place the restraining strap on the canopy, but on second thought, I realized the foolishness of any delay. I exited the kneeling *Corsair* normally but hurriedly. The crash crew arrived, and after ensuring I was uninjured, proceeded to raise the bird, watch the nose gear fall into place, and tow the plane from the runway.

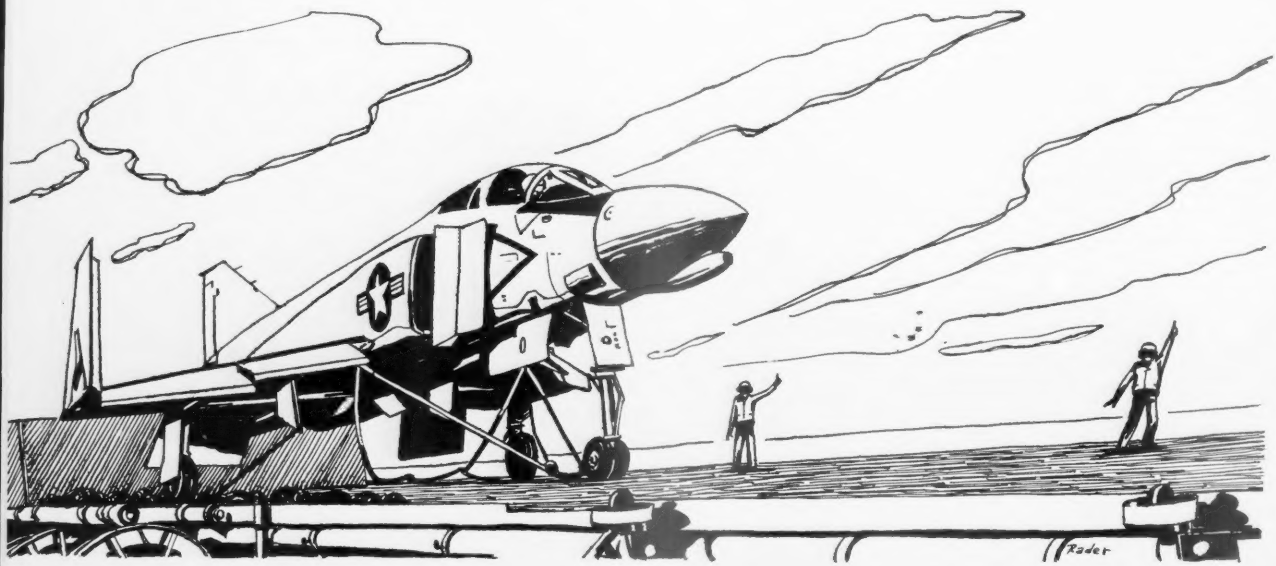
(The major lesson to be learned is that complacency has no place in the cockpit. One can never predict when problems will arise, nor can one always expect outside assistance. In this case, the pilot had no communication with anyone and had to take action on his own. Fortunately, he was prepared and succeeded in preventing a major accident. "Be Prepared." – Ed.)

"Suspend, Suspend, Suspend!"

By AQ1 Doug Nelson and AMH1 Dave Bateman
VF-111

THE plane is on the cat. The huffer is hooked up. The pilot sits in the cockpit, reading the last letter from home – for the fifth time. The RIO, with heavy-lidded persistence, sits behind the pilot, hunched over a Louis Lamour paperback. The tractor driver, with one leg propped on the steering wheel, sits idly wishing for a little shade – maybe a solar eclipse? Yeah! A nice long one. With his helmet pulled down over his eyes, the plane captain lies snoring on the back of the tractor. Two troubleshooters sit leaning against a mainmount, chuckling about some dude in an A-7 who took off with his wings folded. Yeah, really. Back at NAS. How could anybody miss something that big?

"LAUNCH THE ALERT FIVE!" demands the 5MC. Forgotten are the letter, the paperback, the thoughts of shade, the dream half-finished, the sea stories. Everything is hurry up. The yellowshirt director comes sprinting from the island. The troubleshooter safety man appears. The cat crew assume positions. The ordies are scrambling on deck from various directions. Within seconds the entire peaceful scene becomes only a memory. The tractor driver says, "I'm not a tractor driver; I'm just sitting here 'til he gets back." Time is slipping away. The real tractor driver shows. It seems like the huffer takes forever to reach max. The a.c. power from the huffer is DOWN. Everyone is screaming at everyone else. Finally, deck edge power is applied. The bird starts to crank. Time is slipping by quickly. The *Phantom* is finally started. The huffer is pulled away and the aircraft is turned over to the ordies for stray voltage checks. Checks 4.0. Back to the plane captain, who gives the pilot the signal to cycle the controls, then over to the yellowshirt. He signals to break the plane down. Drop the flaps. One troubleshooter on the starboard side; one on the port. They check the bird expertly. Wings, down and locked. Flaps, full down. BLC, functional. Main wheelwells checked. Thumbs-up. The troubleshooter on the starboard comes out behind the starboard mainmount and goes forward to the nose to wait for cat extension. The yellowshirt gives the signal to extend the nose strut. The port troubleshooter hits the end switch, comes out behind the mainmount, and gives the safety man thumbs-up. The starboard troubleshooter comes across the nose, checking the strut and the nose wheelwell, giving the safety man thumbs-up as he runs for the safety box. With a thumbs-up from port and



Twenty men were watching. Forty eyes were looking. Yet they all missed it. How could anybody miss something that big?

starboard, the safety man makes a final inventory: stabilator leading edge down, all controls working. He now gives a thumbs-up to the cat officer. It's his baby now. The bridle goes into tension. Now AB. Everything is GO. Four-and-a-half minutes. Looks like we've done it again. Not our best time, but look at the trouble we had.

What? Suspend?

The cat officer signals to suspend the launch. The bridle goes slack, drops to the deck. The pilot mutters a single syllable as he throttles back on the cat officer's signal. The cat officer talks to the boss on the mouse. Drop the nose and push back, he signals. The nose drops, the flaps come up, the wings fold. Push back on cat one.

"LAUNCH THE ALERT FIVE!"

"Make up yer !!*?*! mind!" grumbles a blueshirt, as he scrambles to grab a chock, placed only seconds ago.

Everyone out of the way! Extend the nose strut. Panic! Not enough air to extend the nose strut. Quick, get the hose from deck edge air. Deck edge air DOWN again? The aircraft has more than that! The *Phantom* is building air fast. Finally enough. Drop the flaps. The bridle is up. The cat goes to tension. The troubleshooters say go. The cat officer says go. The yellowshirt says go. The cat officer starts to raise his arm . . .

Everybody. Freeze.

Right about now the air boss prepares to do two things as he views the scene from his perch on the island. He can see everybody down there. The aircraft is on cat one, at power, and about to go into burner. Inboard and to its left is the safety box. In the safety box squat 14 people. Immediately outboard of them the cat officer stands braced, about to raise his arm. A dozen feet behind him is the troubleshooter safety man in a similar stance, arm extended, thumb up. Inboard of these two men are the cat crew, a cat console operator, the yellowshirt director, the troubleshooters, an EOD man, three ordies from the squadron, the CAG ordie, and the boat's safety officer. On the right side, in the catwalk, is the JBD operator. On the accessory finger squats the cat crew holdback man. Eighteen men. Alert men. To make it an even twenty, we have the pilot of the aircraft, and in the back seat the RIO. The pilot is a senior commander. Almost 19 years at his job. Soon he will have 1000 accident-free carrier arrested landings. He's good. Very good. You don't establish a record like that by making mistakes. The RIO has been with the squadron 15 months. A lieutenant junior grade, looking forward to those railroad tracks. Another highly competent, self-assured professional. Takes pride in knowing his job extremely well.

Twenty men. Forty eyes. Trained, experienced eyes, looking for the unexpected. Seems hard to believe that they could miss the smallest detail. Right? Wrong.

Let's resume the action and see what happens.

The air boss simultaneously does two things. He keys the 5MC mike and throws the suspend switch. "Suspend! Suspend!" blares the 5MC. As the bridle slacks, someone points to the starboard wing. *Unlocked and in the folded position, it points toward the sky like a huge grey tombstone.* "How the hell did someone miss that?" says a rather weak voice from the safety box. How, indeed?

Maybe if we back up a little, we can find at least part of the answer.

As the signal was given to push back after the first suspend, the wings were cycled to the folded position and the flaps raised. Maybe it was noted that the port wing didn't fold. Maybe it didn't register. Most of the eyes were on the port side when the almost immediate order to launch the Alert 5 followed. Did the yellowshirt think that both wings were spread? Did he give the signal to spread the wings? If he did, did the pilot see him? If the pilot saw him, what happened? No one noticed the unlocked condition of the port wing or that the starboard wing (on the opposite side of the aircraft from the safety box) was unlocked and folded. The pilot did not see the telepanel indications of unlocked wings. The RIO missed the two telelights 18 inches in front of him, also indicating unlocked wings.

After the second suspend, the wings were recycled, down and locked verified, and the aircraft flew a normal mission.

If the air boss (or someone else) had not spotted the folded wing, in less than 10 seconds that aircraft would have been catapulted from the deck. Flip a coin. Would the aircrew have lived through it, or not?

Twenty men.

Forty eyes.

As a rather pale troubleshooter walked back to the island, he is heard saying to himself, "How could anybody miss something that big?"

How, indeed?

Letters

One for the road does not make the highway any better.
Ace L.

Re "A Great Rescue"

NAS Key West – While reading the Letters section of the FEB '75 APPROACH, I came across one that brought back memories of a great rescue and outstanding teamwork.

I'm referring to VC-8's rescue of 26 passengers aboard a DC-9 off Saint Croix. I was a VC-8 "Red Tail" at that time and I'm proud to say I worked many times with the H-3 crew that rescued those 26 survivors.

You gave only a quick summation of this episode and I'm wondering if you could write a full story on how the record was made. One more question. Does this rescue record by a single helo still hold, or has it been broken?

ADJ2 Jasper E. Pendry
RVAH-1

• The best source to tell it like it was would be from one of the crewmen who participated in the rescue. Are there any volunteers to send us details for an article? The rescue is still a record for the Navy and, as far as we know, this "Red Tail" crew holds the alltime record.

Fly Us or Trade Us

Fleet Post Office – Professional athletes, after years of being treated as mere chattel, have achieved considerable stature through the courts. Maybe we ought to take our case to court, too.

We're a *Harrier* squadron, on extended deployment, and the opportunity to fly is so sparse one might even call it dangerous. For example, look at Fig. 1 and draw your own conclusions.

Pilot	Sorties	Flight Time
1	32	31.0
2	32	25.9
3	31	30.4
4	35	34.7
5	36	36.1
6	36	34.8
7	34	31.9
8	38	32.6
9	39	34.7
Average	35	32.5

Fig. 1

Now, if the statistics in Fig. 1 were monthly, you'd agree we were earning our pay. *However, the period of time is for 5 months* (152 days)!

We know the supply of fuel is short, the price is high, and all those good things. But only one sortie, of an hour or less, every 4 days, is ridiculous. Further, night landings are almost nil. We haven't averaged two night landings per pilot this whole cruise. How can we sacrifice the safety of a megabuck machine and endanger the lives of pilots in the name of cost effectiveness?

Use my name if you wish, but if I had my "druthers," I'd "druther" you signed me . . .

Rustymouse

• Dear Rustymouse: Your point is most valid. If it's any consolation, the reduced tempo of operations in recent years has played havoc with the proficiency and safety of all deployed squadrons, not just *Harrier* units. Unfortunately, the problems are "bigger than all of us" and there is no quick, easy, or readily available solution to budgetary cutbacks, fuel shortages, high prices, etc. About the only thing you can do is to be aware of your limitations under less than optimum flight scheduling and go about your business in the most professional way you can. Make every sortie count; get the most from every hour. It's tragic but true, that in-between wars, military aviation is in hurtsville.

The Gear Is Pinned

FPO, San Francisco – Having served in naval aviation for about 10 years, I enjoy and heed the lessons others have failed to take to heart.

For example, while reading the DEC '74 APPROACH (Air Breaks), I noticed an article concerning P-3 landing gear pins. I am an aircrew ordnanceman and my ditching station is the starboard aft observer position. Therefore, I am the one who most often is responsible for lowering and raising the boarding ladder. The standardization note in my squadron states: "Landing gear pins shall be stowed under the galley seat, with the streamers exposed." Every time before I raise the ladder, I check not only the streamers, but also to see that the pins are attached.

I continue this practice even when we are involved in a ready alert launch and are unusually hard pressed for time. This

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, Naval Safety Center, NAS Norfolk, VA 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

provides, in a small way, a backup for the pilots and flight engineer who have multiple tasks to perform prior to takeoff.

So far, we have had no gear-down-and-pinned takeoffs, but we are deployed to WestPac and this is just the right environment for things of this nature to occur.

AO1 Chuck Thomas
VP-17

• **Your conscientious performance is to be commended. This seems like a good SOP for all P-3 squadrons to adopt.**

More on Vmc (Air)

Washington, DC – The article entitled "Minimum Control Speed AIR – Vmc (Air)" in the JAN '75 APPROACH contains an error. In presenting statements concerning the optimum bank angle of "5 degrees toward the operating engines," the author states that "... any deviation away from this favorable bank angle increases Vmc..."; he should have stated "... any deviation away from this favorable bank angle *in the direction of the inoperative engine* increases Vmc..." It should also be pointed out that bank angles in excess of 5 degrees toward the operative engines will, under certain conditions (i.e., with high power setting on operative engines or at low gross weights), decrease Vmc. However, a bank angle of 5 degrees toward the operating engines is published as "optimum" due to considerations of maintaining a reasonable attitude in close proximity to the ground. Increasing bank angle increases stall speed and increases the possibility of striking objects on the ground with the wing.

Otherwise, LCDR Hopewell has done a fine job of presenting the facts about the often misunderstood Vmc (Air). Many thanks to him.

Alexander F. Money
Stability and Control Engineer
Airframe Division
NAVAIRSYSCOM

• **The author concurs with your correction.**

Helmets

NAS Kingsville – As a first-class parachute rigger, I have been continuously plagued by pilots refusing to have reflective tape put on their helmets. If we let pilots put their own designs on, most prefer alternating colors other than white. I have always understood that white shows up the best at night and, therefore, should be on visor housings, sides, and backs of helmets. Many pilots have their helmets painted colors other than insignia white. They feel that metal flake paint is reflective enough without tape.

NAVAIR 13-1-6.7 states that helmets should be painted insignia white and recommends red and white reflective tape. Where does the parachute rigger stand in regard to enforcing safety standardization for helmet detectability in a day or night emergency? Sometimes the helmet can be the only means of locating a downed pilot.

PR1 James H. Wiggins
VT-23 Paraloft

• **Reflective tape *is* required to be worn on flight helmets and is *not* the aviator's option. The tape application should cover 80 percent of the visor housing and helmet's outer surface.**

We recognize that reflective tape is commonly applied to helmets to give distinctive markings. While not discouraging this practice, we caution that a realistic approach be taken in selecting tape color and design to obtain maximum detectability in a SAR situation.

You are correct about white tape providing the best reflectivity. NAVAIR 13-1-6.7 does recommend "white or red." In reality, red is a poor reflector (see Fig. 1). If multicolored taping is desired (and it generally is), select any combination of white and yellow, orange, or gold.

Reflective Tape for Helmets

Color	*Reflectivity Grade*
White	35
Yellow	29
Orange	20
Gold	18
Red	8
Dark Red	5
Blue	3

Fig. 1

We discussed with NAVAIRSYSCOM the logic of painting aviator's helmets insignia white as directed by NAVAIR 13-1-6.7. It was generally agreed that helmet color is of little importance since 80 percent of the outer surface is covered with tape anyway. Regardless of the color selected, however, use only paint type MIL-C-22750 or MIL-L-19537 to ensure paint/helmet chemical compatibility.

We're fully aware of the problems that plague the squadron PRs due to the aviator's reluctance to comply with directives concerning his own life support equipment. These problems can be minimized by educating your aviators as to the value of a directive – the reasons why and why not. Second, maintain close liaison with the squadron safety officer. His support is essential.

Friendly Feedback

Ent AFB, CO – It was with much interest and several smiles, grimaces, and outright guffaws that I read your article "How Sierra Hotel * Are You?" in the January issue.

In my several years in the military, it has been my distinct privilege to know many Navy type pilots, all of whom I would rate in the Air Force vernacular of "Sierra Hotel" rather than merely . . . Super Hot.

Lt Col Lee Crock
Editor, *INTERCEPTOR Magazine*
Office of Chief of Safety
HQ ADC (SED)

OUR READERS RESPOND ROUND II

Re "Put Parachutes Back in Helicopters?"

HC-1 Det 2 – LCDR Doege's obvious air of sarcasm in reference to "our intrepid, golden-haired helo boys who leap into their whirlybirds with nothing but a crooked grin and an airy wave of the hand" has very little credence when applied to today's professional helo crews.

It's possible that LCDR Doege did intend to generate serious discussion using satire, so with that possibility I would like to state a rebuttal. It certainly is untrue that helo pilots would not appreciate 'chutes, or for that matter any viable emergency egress system. The safety of our passengers and crews is a primary consideration of all helo pilots.

The problems of successful egress from a helicopter were not completely stated in the article, however. While each of his four points could be modified and discussed, LCDR Doege totally neglected two of the major concerns regarding successful bailout.

If the helo is in autorotation, the acceleration of air through the rotor system would hamper the survivor's attempts to clear the aircraft. If, however, the rotor system's RPM has decayed, the helo then becomes an uncontrollable falling object with an excessive rate of descent, and again separation from the airframe would be difficult. Combine these two conditions with low altitude operations, and the chances of successful bailout are minimal. Perhaps a review of LT Delorey's account in the JUL '74 APPROACH would enlighten many of us to the difficulties of helo bailout. Remember that his aircraft still had some controllability when they bailed out.

Few helicopter pilots will argue against 'chutes for certain emergency situations, such as fire. However, the current use of the NB6 parachute is unsuitable because of weight and size. The outfitting of 13 passengers and four crewmen would add undesirable weight (22 pounds each), take up valuable space, and hinder SAR operations.

I feel it's far more important to design structurally safe helicopters with improved rotor systems capable of successful autorotations. Present designs and flight regimes demand the latter reasoning to the safe completion of our mission.

LT K. W. Curtis

NASA, Langley Research Center – LCDR Doege stated that a valid argument against wearing parachutes in helicopters is their clumsiness and restriction of movement. I invite your attention to two 'chutes currently in use by NASA pilots at Langley Research Center. Both are used in helos and light aircraft. They are the Security Safety-Chute, Model 150, and the Pioneer Thinback, Model PA-TP-26-(2).

Both parachutes weigh about 16 pounds, are extremely comfortable to wear, and require no removal of seat cushions, even in the smallest light airplane. The *Pioneer* has a barometric device for automatic opening which can be set anywhere between 1000 and 3000 feet AGL. A possible drawback for Navy use is that both parachutes are limited to 150 knots max airspeed. Another possible drawback might be its incompatibility with other survival gear required to be worn by Navy pilots.

There may be other manufacturers of similar parachutes, but I can only speak for the two we use. Either one has been satisfactory for our use.

K. R. Yenni
Technologist/Pilot

NAEC Lakehurst – As a Navy helicopter pilot I read LCDR Doege's article, "Put Parachutes Back in Helicopters?" in the FEB '75 APPROACH with interest. I thought about past readyroom discussions and the oft asked question about what were the possibilities of striking rotor blades during bailout, thus nullifying the benefits of parachuting. The answer to this question

remained unanswered in my mind until reading an article in the January 1975 issue of the *Journal of the American Helicopter Society* entitled "Parachute Escape from Helicopters," by Col William P. Schane, M.D., Director, Aviation Medicine Research Division, U.S. Army Aeromedical Research Division, Fort Rucker, AL 36360. I believe that anyone who has considered the problem of parachuting from helos will find this most beneficial and interesting.

LCDR Carl S. Park

MCAS(H) Santa Ana – Regarding LCDR Doege's article in the FEB '75 APPROACH, "Put Parachutes Back in Helicopters?" I agree – with qualifications.

First of all, the present generation of Navy/Marine Corps helicopter cockpits, pilot seats, and escape hatches were not designed for wearing parachutes or egress in flight with parachutes. Before NAVAIRSYSCOM spends scarce dollars to retrofit certain models – or our whole fleet of helicopters – so that parachutes may be effectively worn and utilized, the statisticians are going to have to come up with some pretty convincing figures to prove the cost benefits. While it is a difficult and emotional job to cost out aircrews, it can be done. How many helicopter crews have we lost who would have been saved had they worn parachutes?

When I flew the UH-34, we had the option of wearing parachutes on certain missions, particularly cross-countries when minimum enroute altitudes were sometimes rather high. Fire in the UH-34 at altitude was justifiably feared because of its magnesium skin. When we went to Vietnam in 1963, however, body armor was more important than parachutes.

I am flying the CH-46 now. I was initially opposed to the modular recovery system when I first heard about it in 1970 (NOV '74 APPROACH). It is a case of all or nothing. We either get the system or we don't (and it's expensive). In operation, if one phased element fails, you've had it. Up until 1972 in South Vietnam, radar controlled guns and heat seeking missiles weren't the threat they are today throughout the world. The modular recovery system or some type of ejection seats may be the best answer for mid/high altitude catastrophic failure in peacetime or combat in our next generation helicopters. But as a fallback, least cost option, they should be designed so crewmembers can wear parachutes.

I believe we need to emphasize four areas in the development of our design requirements for future helicopters: combat effectiveness, simplicity, redundancy, and crash worthiness. These are not necessarily conflicting requirements. By *combat effectiveness* I mean, can the machine get the job done under the exigencies of war? In emphasizing *simplicity,* we need to reduce moving parts and systems, perhaps going to more revolutionary designs, such as a stowable rotor/fixed-wing jet hybrid or a direct thrust/diffused thrust VSTOL aircraft. By *redundancy,* I mean fail-safe rotor blade spars, transmissions, and not co-locating hydraulic lines/cables/rods, so with one hit you lose control. *Crash worthiness* is very important. Military helicopters are going to crash, and we need to improve survivability for crew and passengers. Fires are one of the major problems in many helicopter crashes. Reticulated foam in the fuel cells would help, and jettisonable external range extension fuel tanks should be mandatory vice the current internal range extension tanks.

Finally, helicopters are being forced more and more to fly routinely at higher altitudes because many military airfields and positive control areas require that we file IFR rather than VFR or Special VFR. This is an example of "heads in the sand" lumping all military aircraft together, with helicopters being forced to comply with operating rules designed for fixed-wing aircraft.

Helicopters have their own unique capabilities and deficiencies. It would be nice to have the option to wear a parachute for high altitude missions if for no other reason than to reduce the accumulation of grey hairs on pilots' heads.

Maj Howard M. Whitfield, USMC

FPO, San Francisco – After reading "Put Parachutes Back in Helicopters?" in the FEB '75 APPROACH, I couldn't agree more. I fly UH-1Es in a composite squadron at the present time.

There was one point which you brought out that deserves further consideration – that of not having your passengers getting out. In the Marine Corps, many practice vertical assaults are made in order to keep the proficiency at an optimum level so that the Air/Ground Team will function when necessary. It is difficult to have passengers wear flotation devices when flying over water, but if you add a parachute to this plus full combat gear, I'm sure that a protest will be heard. If the program of wearing parachutes was instituted, it most likely would be tolerated until a better system could be devised.

As far as the attitude of "when it is my time to go . . . " I have had to adopt this because I would like to use a parachute, but there are none available. This way I can get over some of my apprehensions of certain particular emergencies and/or circumstances.

I am in favor of that one extra chance or alternative provided by a parachute. At least it would let me go out trying if I go at all.

lstLt R. P. Cotten, USMC

approach

Vol. 21 No. 1

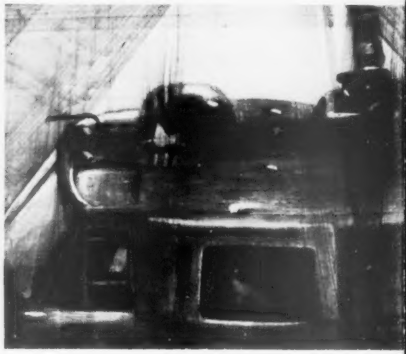
NAVAIR 00-75-510

Pg. 1

Pg. 5

CONTENTS

1 What the Incident Reports *Really* Mean
By LCDR C. J. Winters
4 The 'G' in Poopy Suit Is Silent
By LCDR Red Best
5 "Roger, Coupled Ball"
By LCDR T. A. Myers
9 Bravo Zulu
10 Wake Up to Wake Turbulence
13 Three Blind Mice
14 Smoking and Heart Disease
16 Beware the Reflections
By CAPT Howard M. Hoffman
18 Psychological Profile
By R. A. Alkov
20 Severe Weather
24 Be Prepared
26 "Suspend, Suspend, Suspend!"
By AQ1 Doug Nelson and AMH1 Dave Bateman



Pg. 16

DEPARTMENTS

28 Letters

Our product is safety, our process is education, and our profit is measured in the preservation of lives and equipment and increased mission readiness.

PURPOSES AND POLICIES/APPROACH presents the most accurate information currently available on the subject of aviation accident prevention. Contents should not be considered as regulations, orders, or directives and may not be construed as incriminating under Art. 31, UCMJ. Photographs used to illustrate articles in APPROACH do not necessarily reflect the actual aircraft, air stations or ships that are described in the text.

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CREDITS/This month's cover, by R. G. Smith, recognizes the Navy's rugged C-9B *Skytrain II*, while marking the 20th anniversary of APPROACH. Courtesy McDONNELL DOUGLAS.

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FINAL APPROACH

TWENTY years ago this month, July 1955, the first APPROACH was delivered to the Fleet. The principal consideration of this magazine was then, and is today, you, the reader. Known then as *The Approach,* its purpose remains the same, *accident prevention.*

Reviewing the contents of Vol. 1 No. 1, I am struck with a singular note of similarity as compared to this month's issue. While both the hardware and software have evolved from "simple" to "complex," the human element has remained unchanged. We've the same reactions (albeit perhaps by necessity, quicker), we're equipped with the same appendages, our brains haven't increased in size, and our will to survive is no stronger than it was in the mid-fifties; yet, we've lowered the accident rate from 3.8 in fiscal '55 to .75 (estimated) in fiscal '75. Why?

Without espousing the old "safety and motherhood" theme and glorifying the success of NATOPS, let's put the credit where it really belongs – on the professionals – the pilots, aircrewmen, and maintenance and support personnel. Credit especially those whose efforts fall just short of an ATTABOY or a BRAVO ZULU, yet whose sustained, consistent performance gets the birds back home time and time again, or keeps 'em on the deck when they're not in condition to fly safely.

In the first APPROACH, the following paragraph dedicated the magazine and its purpose:

This is your magazine. We urge your assistance in making it the approach to positive safety in naval aviation.

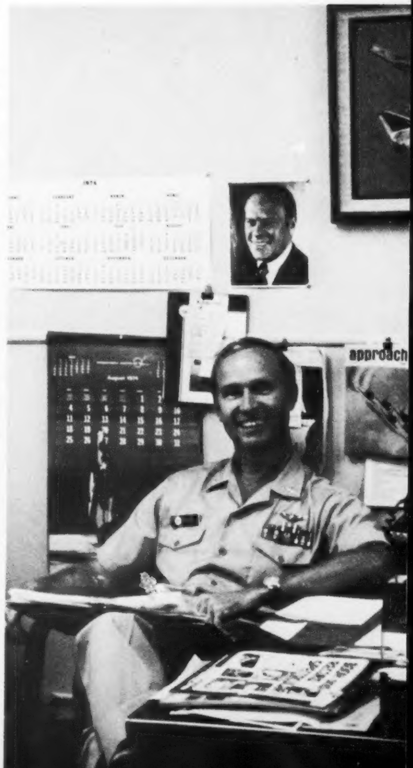
It's just as true today. It belongs to the Fleet – past, present and future. You've made it what it is today.

As this twentieth anniversary issue is distributed, it will, at the same time, mark the twentieth anniversary (to the month) of my enlistment as a NAVCAD. I have had the opportunity to serve as editor-in-chief of APPROACH for 48 issues – a fantastic assignment! It has not been just another desk job. I've been fortunate enough to continue flying "Fleet type" aircraft, and by so doing, have had the opportunity to meet the "next generation" of naval aviators. In all honesty, I've been tremendously impressed.

My thanks to all who've made this, my final tour, so gratifying – especially those officers and men of Fighter Squadron FORTY-THREE. I salute all those who've contributed to our safety publications, and even those who've disagreed with our editorial policy – and taken the time to let us know about it. Please continue to support my successor with your valuable inputs.

May your winds at altitude always be strong and following, your night traps always "pinkies," and may your low fuel light never illuminate prior to the chocks. Keep 'em flying – safely.

Floyd E. Sykes
Editor-in-Chief



DECLARATION OF INDEPENDENCE

In CONGRESS, July 4, 1776

The UNANIMOUS DECLARATION of the thirteen united STATES OF AMERICA.

WHEN in the Course of human events it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.–We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.–That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed,–That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security.–Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world.–He has refused his Assent to Laws, the most wholesome and necessary for the public good.–He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them.–He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only.–He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them into compliance with his measures.–He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people.–He has refused for a long time, after such dissolutions, to cause others to be elected; whereby the Legislative powers, incapable of Annihilation, have returned to the People at large for their exercise; the State remaining in the mean time exposed to all the dangers of invasion from without, and convulsions within.–He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws of Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands.–He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary powers.–He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries.–He has erected a multitude of New Offices, and sent hither swarms of Officers to harass our people, and eat out their substance. He has kept among us, in times of peace, Standing Armies without the Consent of our legislatures.–He has affected to render the Military independent of and superior to the Civil power.–He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation:–For quartering large bodies of armed troops among us:–For protecting them, by a mock Trial, from punishment for any Murders which they should commit on the Inhabitants of these States:–For cutting off our Trade with all parts of the world:–For imposing Taxes on us without our Consent:–For depriving us in many cases, of the benefits of Trial by Jury:–For transporting us beyond Seas to be tried for pretended offences:–For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies:–For taking away our Charters, abolishing our most valuable Laws and altering fundamentally the Forms of our Governments:–For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.–He has abdicated Government here, by declaring us out of his Protection and waging War against us.–He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people.–He is at this time transporting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, already begun with circumstances of cruelty & perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.–He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands.–He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare, is an undistinguished destruction of all ages, sexes and conditions. In every stage of these Oppressions We have Petitioned for Redress in the most humble terms: Our repeated Petitions have been answered only by repeated injury. A Prince, whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people. Nor have We been wanting in attentions to our British brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends.–

WE, THEREFORE, the Representatives of the UNITED STATES OF AMERICA, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be, FREE AND INDEPENDENT STATES; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do.–And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

John Hancock
Button Gwinnett
Lyman Hall
Geo. Walton
Wm. Hooper
Joseph Hewes
John Penn
Edward Rutledge
Thos. Heyward, Jr.
Thomas Lynch, Jr.

Arthur Middleton
Samuel Chase
Wm. Paca
Thos. Stone
Charles Carroll of Carrollton
George Wythe
Richard Henry Lee
Th. Jefferson
Benj. Harrison

Thos. Nelson, Jr.
Francis Lightfoot Lee
Carter Braxton
Robt. Morris
Benjamin Rush
Benj. Franklin
John Morton
Geo. Clymer
Jas. Smith

Geo. Taylor
James Wilson
Geo. Ross
Caesar Rodney
Geo. Read
Tho. McKean
Wm. Floyd
Phil. Livingston
Frans. Lewis
Lewis Morris

Richd. Stockton
Jno. Witherspoon
Fras. Hopkinson
John Hart
Abra. Clark
Josiah Bartlett
Wm. Whipple
Saml. Adams
John Adams
Robt. Treat Paine

Elbridge Gerry
Step. Hopkins
William Ellery
Roger Sherman
Sam. Huntington
Wm. Williams
Oliver Wolcott
Matthew Thornton